HEATING AND VENTILATING

Reg. U. S. Pat. Off.

C. H. B. HOTCHKISS, *Editor*
CLIFFORD STROCK, *Associate Editor*
A. S. ARMAGNAC, *Advisory Editor*

formerly The Heating and Ventilating Magazine

CLIFF W. PRESDEE, *General Manager*
GEORGE G. TURNER, *Western Manager*
JOHN F. HYDE, *Eastern Representative*

CONTENTS

Public Buildings and Institutions Reference Number

VOL. 28 **APRIL 1931** **No. 4**

Editorial 57
Problems of Library Heating and Ventilation ..... *Samuel H. Ranck* 58
Modern Piping and Humidity Control Features of New Capitol ..... *Samuel A. McGuire* 67
Fin Type Radiation as Used in Public Institutions ..... *G. Kendrick Bringhurst* 72
Design of Mechanical Equipment for an Ice Rink and Dance Hall ..... *C. E. Daniel* 76
Heating and Ventilating Design for an Outstanding Public Building 81
Some Impressions of Current Practices with Public Building Plants 86
Air Conditioning Special Hospital Rooms ..... *G. T. Shoosmith* 88
Calculating the Proper Thickness of Insulation ..... *Edgar C. Rack* 92
State Laws on the Heating and Ventilating of Institutions 97

Departments

Abstracts 98
News of the Month 101
New Apparatus and Appliances 111
With the Manufacturers 118
Monthly Degree Day Data for February, 1931 120
Statistical Service 124
Weather for February, 1931 126

Reference Numbers

September, 1931 Issue—Office Buildings

December, 1931 Issue—Theatres

Reference numbers already published—School Buildings, September, 1930; Industrial Buildings, December, 1930.

NATIONAL TRADE JOURNALS, INC., 521 FIFTH AVE., NEW YORK, N. Y.

WHEELER SAMMONS, *Chairman of the Board*
H. J. BLIGH, *President and General Manager*
E. J. ROSENCRANS, *Secretary and Treasurer*
H. J. REDFIELD, *Comptroller*

Published monthly, $2 per year in United States and Mexico. $2.50 in Canada. $3 in all other countries. Single copies, regular issues, 30 cents. Single copies, reference numbers, $1.

CHICAGO OFFICE: 75 *East Wacker Drive*

EUROPEAN REPRESENTATIVE, *W. G. Hollinworth, Somerleyton Road, Oulton, Lowestoft, England.*

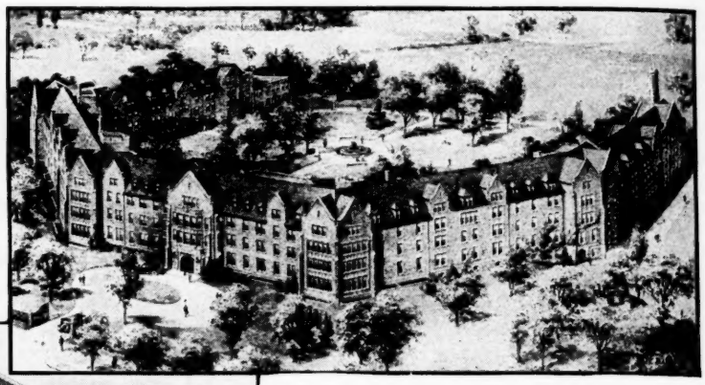
Copyright, 1931, by National Trade Journals, Inc.

PHILADELPHIA HOSPITALS KNOW

The Secret of Dependable Heating

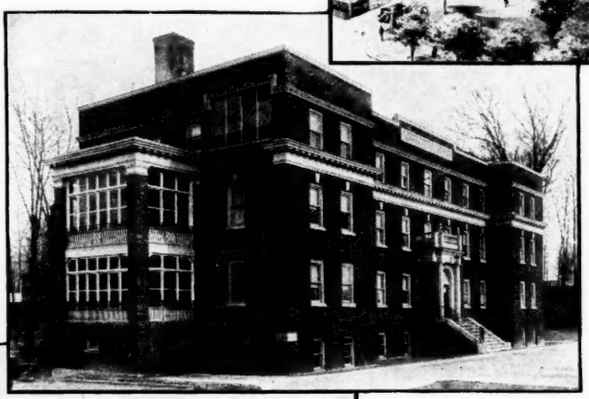
Where human life often depends on keeping patients warm, it is dangerous to take chances with radiator traps that may fail to function just when most needed.

Because of their proved dependability over a long period of years, Sarco Radiator Traps are the favorite with a large percentage of America's leading architects, engineers and contractors.



Philadelphia Home for Incurables.

The Ballinger Co., leading Philadelphia Architects, specified Sarco Radiator Traps for these fine buildings.



Delaware County Hospital, Philadelphia.

Hanover Hospital and Nurses' Home, Philadelphia.

SARCO RADIATOR TRAPS

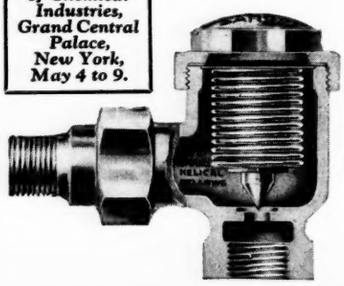
have an unusually large discharge opening and high lift giving greater capacity.

SARCO HEATING SYSTEMS — BUILT TO A QUALITY STANDARD

Long uninterrupted service is assured by the heavy helical bellows, having a continuous spiral of corrugations, that insures even distribution of the movement and eliminates "wear spots."

These traps cannot air bind or freeze. Many other features explained in our Booklet P-75. Send for a copy.

See our Exhibit at Booth No. 34, Exposition of Chemical Industries, Grand Central Palace, New York, May 4 to 9.



SARCO CO., INC.

Manufacturers also of Inlet Valves, Air Eliminators, Thermostatic Return Traps, Drip Traps, Temperature Regulators and complete equipment for heating systems.

183 Madison Ave., New York, N.Y.

Branches in Principal Cities

SARCO CANADA LIMITED
Federal Bldg., 85 Richmond St., W., Toronto, Ont.

SARCO CO., Inc.
183 Madison Avenue, New York, N. Y.
Without obligation, you may send the following:
☐ Radiator Trap Booklet P-75.
☐ Complete Heating Equipment Catalog P-40.
Name.....
Address.....
City.....State.....

Compulsion or Conviction—Which?

DURING the past several months I have been privileged to examine the heating and ventilating plants in a large number of publicly erected buildings; to talk with operating men, with designing engineers both in public employ and in private practice, and with contractors who erect much apparatus in such buildings. The care given to the planning of the equipment, the thought with which specifications are drawn, and the fine appearance of many of the plants are points which stand out among all the impressions of the period. It may be that less attention is paid to public work, or that less skill is used in its design, than in private work of a like character, but it is certainly doubtful. In fact, in many cases, more careful and detailed attention is given to these buildings than is true of lots of privately built ones.

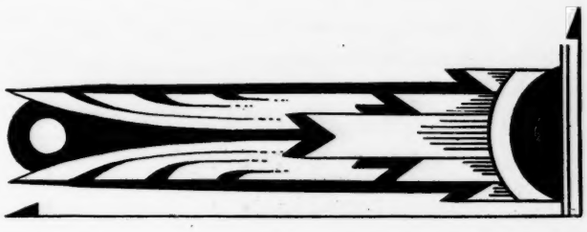
In the course of many conversations relating to the preparation of the plans, the talk would finally come around to the failure of the appropriation to cover the desired and necessary mechanical equipment. Many designers seemed to feel that due to the necessity of cutting to meet appropriations the plant was much more often skimped rather than loaded with equipment. But when appropriations were adequate the resulting plant seems to be in every way the equal of similar plants in private buildings.

The general survey of public building practice made possible through the preparation of material for this issue served to bring to notice again the fact that very few states indeed have enacted any laws regulating the minimum requirements to be demanded of such buildings. Laws requiring the observance of certain rules and minimums regarding other features, such as the method of letting contracts, are rather plentiful. In many states the deliberate policy of letting cities set up their own requirements is followed, and public buildings are required to conform to local enactments. Inquiries commonly brought back the reply "We have no laws on the subject except those applying to schoolhouses."

The fact that state laws relating specifically to schools are widespread, while practically none are in existence applying to other publicly erected buildings, leads to the question of the comparative general excellence of the heating and ventilating installations in each class. Admittedly, the conditions surrounding the use of the buildings are not exactly the same, and consequently a direct comparison is difficult. As a rough guess it is difficult to see that the schoolhouse installations made under state laws excel the installations made in other public buildings without state laws setting up the requirements to be met.

Until additional evidence can be produced showing definitely that there is a need for state legislation on the subject, and in view of the fact that the results of such legislation applied to schools have not been wholly happy, it seems that efforts to cause such enactments are open to question. An equal expenditure of time and effort along the line of convincing officials of the positive necessity for making adequate provision for a suitable plant in the financial set-up will lead to more effective results than will any laws which attempt to force the provision.

When suitable financial provision is made the ability of the engineer to secure a satisfactory plant seems to be proved by the present record. Why surround him with legislation if he can accomplish the result without it? The mere passage of laws may very easily serve to antagonize those responsible for the financial arrangements unless they are fully convinced of the value to be gained! Once convinced there will be little necessity for compulsion.



Ewing Galloway

Kellogg Library, Green Bay, Wisconsin, in the Foreground

Problems of Library

ADEQUATE ventilation for public, college and university libraries, used by large numbers of people, must provide three things:

1. An abundance of good, wholesome air free from dangerous bacteria and gases, with temperature, humidity and motion that insure comfort both for the employees and users of the library.

2. A proper degree of humidity, for the sake of the people in the library, for the sake of the books, and also for the sake of the furniture, if it is of wood.

3. Elimination so far as possible of dust, dirt, and smoke, both for the sake of the people and for the sake of the books.

The most important factors in the above are temperature, humidity and motion, but all are factors and the combination of these variables for successful results is often exceedingly difficult. The problem of ventilating a library used by large numbers of people is not a problem primarily of ventilating a building, but one of ventilating people, books, and furniture.

LIBRARY VENTILATION A DIFFICULT PROBLEM

The problem of ventilating a library building is more difficult than that of the average public building, for the reason that our larger libraries are open longer hours per day or week than other public buildings, and therefore there is not the opportunity for airing out the building by natural ventilation. Many of our public library buildings, and many college and university library buildings during the term, are open 80 or more hours a week, and every day of the week; often every day of the

Lecture Audience in Library Room in Grand Rapids. The Severity of the Weather is such that it is Inadvisable to Open Windows with the Result that, Due to the Character of the Audience, the Air Conditions are Almost Intolerable.

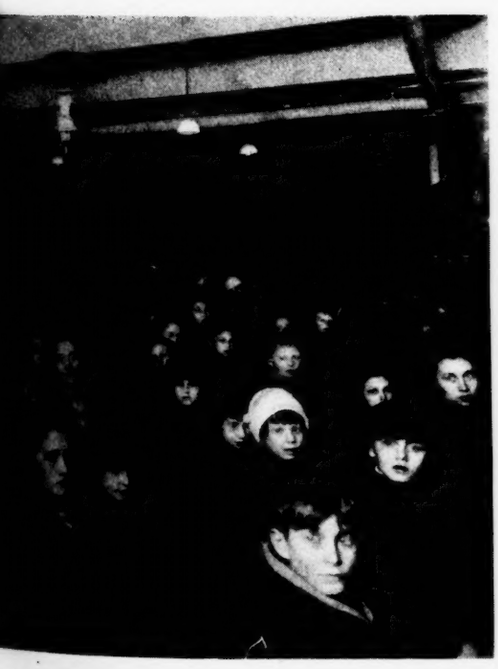
Ewing Galloway

The Huntington Library in Los Angeles is Air Conditioned Throughout.

Heating and Ventilation

by* Samuel H. Ranck

year, with the possible exception of Christmas and July Fourth, and there are cities in which the libraries are open to the public even on those two days. Churches, theatres (certain movie theatres being exceptions), schools, and other public places are rarely open half the number of hours per week that a library is, and some of them less than one-tenth the number of hours in the course of a year.



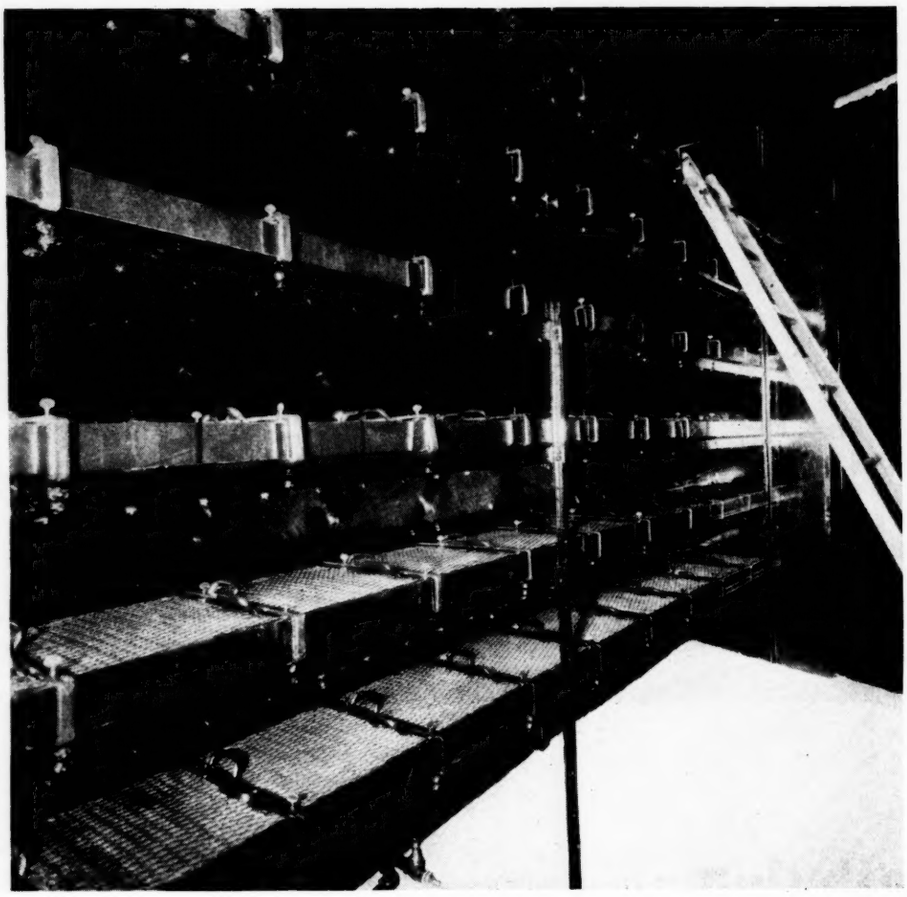
VARIABLE VENTILATION LOAD

The library ventilating problem is also complicated by the fact that in addition to long hours there is a variable load at different hours of the day, and different rooms at the same hour, all of which makes the problem still more difficult. The ventilation load may be defined as the number of persons in a room to be ventilated and the variable load is due to the fact that the number of persons in certain rooms varies greatly at different hours of the day. In other words, the library cannot deal with what might be termed a constant ventilation load as is the case usually in a school building.

A reading room for teachers, or even a children's room, illustrates what is meant by variable load. Such rooms may have very few or no readers at all during certain hours of the day, whereas at other hours, the children's room, for example, after school or on Saturdays of a winter month, may be crowded to suffocation during certain hours. On the other hand, a newspaper or magazine room may be crowded all day long, with standing room only at a premium at times. The amount of air required for good ventilation under such circumstances in the same building in these different rooms,

---

**Librarian, Grand Rapids Public Library; Chairman, Committee on Ventilation and Lighting of Library Buildings, American Library Association.*



Inside View of Air Filter in Fifth Avenue Public Library. Hot Water or Oil Directed Through a Hose on the Top of the Filters Keeps them Clean.

therefore, means that one room must have many times as much fresh air as another, with corresponding changes in the temperature of the air entering the room or of the room itself.

THE PROBLEM OF ODORS

In our large cities, and particularly cities where there are large railroad terminals, public libraries have an additional problem in the winter months (always more or less acute in these months, but especially so in times of great unemployment), when newspaper rooms become the crowded resting place (sometimes the sleeping place) of unemployed persons, who find the library warm and cozy as compared with the chilling blasts outside. It is not unknown in children's rooms for children of some nationalities to have their clothing sewed onto them in the fall, with no change of clothing until spring. Bathless persons like the foregoing bring to the library the problem of odors, a problem which often becomes extremely difficult in children's rooms and in newspaper rooms.

This problem is intensified among certain groups of children with a foreign background where garlic and onions are favorite articles of diet, and when they carry asafoetida tied up in a bag around their necks to serve as a disinfectant or as a charm against sickness. The problem of the unbathed, with articles of diet that are frequently most offensive to many persons, is a real one, for these odors nauseate some people. It is up to the library to have a system of ventilation to reduce such offensiveness to its lowest terms, best solved by moving the air in such rooms in vertical lines instead of lines more or less horizontal.

Some libraries have attempted to solve the problem of odors by using an ozone machine and pumping the ozone generated by such a machine into certain rooms along with the air. However, I have never seen such an equipment that was wholly satisfactory. To be effective in killing or masking the odor, the ozone is so strong that it is immediately noticeable on entering the room, and then it is usually irritating to the delicate membranes of the eyes and nostrils.

THE LECTURE ROOM PROBLEM

Another type of room that complicates the problem of ventilation in a library is one that is used for lectures or other purposes bringing people together in mass. A lecture room filled to capacity usually seats from three to four times as many persons in the same area as when it is used as a reading room, thus causing a wholly different problem of ventilation in two rooms otherwise identical. Such differences must be considered in the layout and operation of ventilation machinery.

In the Ryerson Building—the main building—of the Grand Rapids Public Library, we have a very good illustration of the problem as it relates to two rooms of the same size, but used for different purposes. In this building the main reference room and the lecture room are on the same floor, and are identical in area and cubical contents. An audience of 300 or 325 persons in the lecture room will ordinarily raise the temperature at least 10° in the course of an hour when it is freezing outside, whereas with the same amount of air at the same temperature coming into the reference room, seating nearly 100 persons, that room would be comfortable, with the lecture room most uncomfortable. This building is heated and ventilated by the plenum system, so that when the lecture room is comfortable the reference room and other rooms in the building are entirely too cold.

On the other hand, if the other rooms are comfortable the lecture room is hot and stuffy, and people have difficulty in keeping awake, with the result that many people go away pronouncing what would otherwise be regarded as an excellent lecture, more or less of a failure, simply because they were uncomfortable and sleepy by reason of poor ventilation.

We have remedied this difficulty somewhat in the Ryerson Building by shutting off the heated air from the plenum fan for the lecture room several hours before the lecture begins, and opening the windows wide,

thus getting the temperature of the room down to about 60°, and at the same time chilling the walls of the room so that they will absorb a considerable amount of heat when the room warms up from the lecture crowd. When it occasionally happens that only a very small audience appears, our problem is to get the room five or more degrees warmer as soon as possible. The fan, forcing the air that keeps the rest of the building comfortable, takes on the load of the lecture room 20 minutes or half an hour before the lecture begins. In that way we manage to get through the lecture fairly comfortably although the temperature, even when it is down to 60° at the beginning of the lecture hour, with the rest of the building comfortable, frequently goes up to 75°—and is therefore uncomfortable.

WHAT A BIG CROWD DOES TO VENTILATION

A most interesting analysis of what happens when an extra large number of people are in a room for a considerable time is given in a paper by G. L. Larson and C. Braatz.* Those of us who have had the pleasure of going through or using the beautiful Memorial Union building of the University of Wisconsin can readily visualize the descriptions in this article. The Great Hall contains 5,040 sq. ft. of floor space. Normally it is a lounging room for students and on Friday nights there is a student dance with a usual attendance of from 100 to 150 couples. Occasionally the room is also used for banquets. For all these purposes the ventilation system is adequate and satisfactory. The ventilating fan can deliver 12,300 cu. ft. of air per min., approximately 2½ cu. ft. of air per sq. ft. of floor space, a cubic foot per minute more than the State ventilating code calls for.

*"*Peak Load Must be Considered in Design of Air Conditioning Systems,*" Heating, Piping and Air Conditioning, *September*, 1930.

WISCONSIN JUNIOR PROM OF 1930

The Junior Prom of 1930, held on the night of February 7, served as a most interesting laboratory experiment for all who are interested in ventilation. For this affair several recording thermometers and a humidity recorder were installed in the Great Hall, by means of which a history of temperature and humidity conditions was recorded.

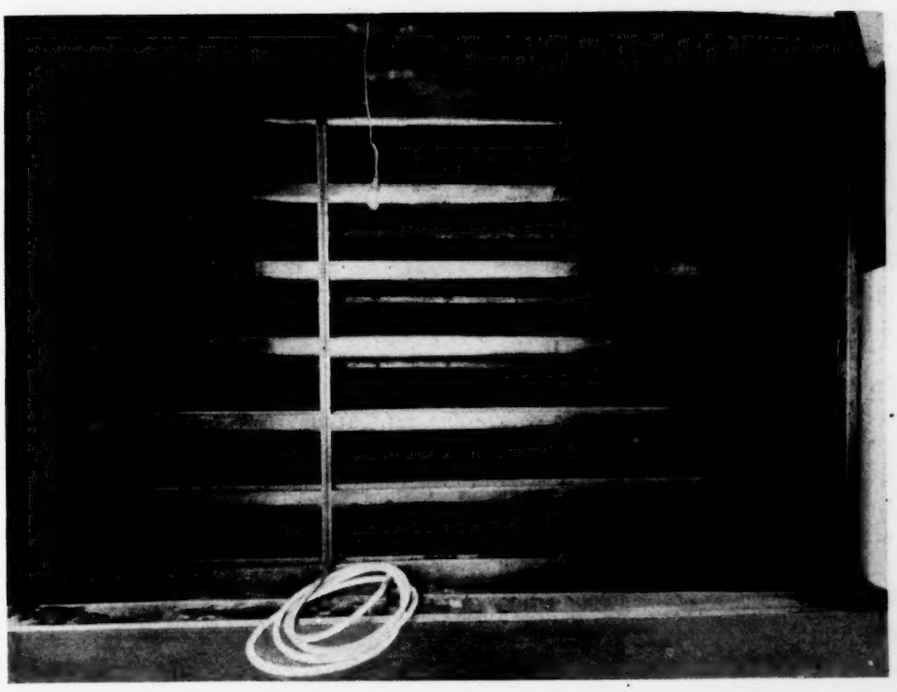
Early in the afternoon of the dance all heat was shut off and cold air sent in to the Great Hall so as to cool the building before the arrival of the crowd and so that the walls might absorb some of the heat developed by the people.

The average adult normally clothed and at rest, gives off about 400 B.t.u. per hr., while one at work gives off from 550 to 600 B.t.u.—an increase in the quantity thrown off of approximately 50%. The number of tickets issued for this prom indicated an attendance of 750 couples. Assuming that two-thirds of these were in the Great Hall for the first dance and also assuming that dancing under such conditions is work, at least in the energy used, the dancers alone were the equivalent of a heating plant with a capacity of not less than 550,000 B.t.u. per hr., which for the outside temperature conditions of that night is approximately three times the amount of heat required to maintain the Great Hall at a temperature comfortable for dancing, say 65°, assuming the proper humidity. "And had it been an extremely cold night," to quote the words of Messrs. Larson and Braatz, "20° below zero let us say, the dancers would still have developed 48% more than the required amount of heat. Hence, the problem of keeping the dancers comfortable, even in extreme weather, is one of cooling rather than heating."

The temperature of the air discharged into this Great Hall during the first dance was 40°, at the rate of 12,300 cu. ft. every min., and yet notwithstanding this and the chilling of the Hall and the walls before the arrival of the crowd, the temperature rose from 61° to 70° during this one dance.

The humidity recorder showed that the average moisture evaporation from dancers that night was 33 gal. per hr., or 276 lb., and at midnight the rate of evaporation was 43 gal. per hr. The total humidity loss per person during that prom at Madison was approximately a pound per person—or about three-quarters of a ton of water absorbed by the air, or approximately three and a half barrels of 50 gal. each.

Conditions in a library are never identical with those at the Madison Memorial Union building on the



Outside View of Air Filter. Use of these Filters in New York Reduced the Sulphuric Acid from 0.2 Parts per Million at the Intake to Zero in the Book Stacks.

night of a big dance, but both for temperature and humidity they are similar, and the details and data given in the articles are most suggestive and illuminating for everyone interested in the problems of library ventilation.

LIBRARY VENTILATION MUST BE CONTROLLED

From experiences of this sort which I have observed in other library buildings I am convinced that it is absolutely necessary in planning the ventilating system of a library that the heating should be independent of the ventilating system, and furthermore, in a large library building it is necessary for good results that the ventilation be controlled in every public room at every hour of the day in accordance with the conditions in that room. This means that fans must be used, for I believe it is impossible to control the ventilation of a large library building without the use of a fan system, and ventilation of such a building worthy of the name *must be controlled.* There are various methods of handling this problem, all of which are more or less familiar to architects and ventilating engineers.

Fans are not necessary in a small library building or one that is little used. Natural ventilation properly provided for and supervised will meet the needs of such situations. Climate and latitude are also factors that must be taken into account. Ventilation problems in the states bordering on the Gulf of Mexico or those on the Mexican border are quite different from those of the Canadian border where the temperature in winter often goes down to 20° or more below zero. Librarians and architects must take account of climatic conditions in planning their buildings.

I might add in this connection that in our new West Side Branch library building, where we have a lecture room seating over 300 people, the heating is entirely separated from the ventilating system. Steam radiators in the several rooms are used for heating the building, and when a small number of persons are in the rooms, they are ventilated by natural ventilation, and when a large number are in the rooms, by fan ventilation, the air which comes in with the fan being tempered so that it does not chill the people, but never heated so as to take away from it the feeling of freshness. For the lecture room we have a fan system which is entirely separated from the fan system of the rest of the building. In this way it is possible to control to a very large degree the amount of air that is brought in for ventilating purposes, with some relation to the number of people in the room.

THE PROBLEM OF HUMIDITY

In a library building the problem of humidity is one of very great imimportance: first of all, for the sake of people; second, for the sake of the books; and third, for the sake of the furniture, as already stated. I have seen thousands of dollars worth of fine, expensive furniture warped and cracked because the air was too dry, and fine veneered woodwork and furniture peeled and ruined because of the air being too moist.

Humidity greatly affects the evaporation of moisture from the human body. Air next to the body, if it is not moving, soon becomes saturated and then evaporation ceases. This raises the temperature of the body, with the result that high relative humidities produce the same physical discomfort as high temperatures.

Professor J. A. Myers, of the University of Minnesota, in discussing temperature, humidity and freshness of air as they affect one's ability to work, writes as follows:* "When working in stagnant air at 75° F. with a humidity of 50%, it was found that only 76.6% as much work was done as when working in rooms with 68° F., 50% relative humidity and fresh, circulating air."

Books and paper may also be greatly injured by the lack of proper humidity, and this is particularly true of books bound in leather. Excessive dryness reduces the strength of the paper, and excessive humidity may cause the books to mould. In a moist warm climate mould may be the cause of great damage to the books and there the problem of ventilation is to reduce the moisture content of the air. After more than 35 years of experience in dealing with such problems in library buildings I have come to the conclusion that the degree of temperature and humidity that is most satisfactory for human beings is a fairly satisfactory degree of humidity and temperature for books.

In our oldest libraries one may see thousands of leather bound volumes, with the hinges broken off or loose, not from usage, but because the binding has simply crumbled away into dust on account of the disintegration of the leather. This disintegration is caused almost entirely by excessive heat and excessive dryness. The result of all this is that most public libraries have given up the binding of books in leather, and have substituted fabrics—cloth, buckram, and canvas, or artificial leather such as fabrikoid. Leather, of course, is by all odds the most attractive of bindings, but it is almost impossible to get modern leathers in quality that will stand up against the atmospheric conditions of modern library buildings. This is partly due to modern methods of tanning, where sulphuric acid is used to a considerable extent in the process of finishing and dyeing the leather and a trace of the acid remains in the leather after the tanning process is completed.*

The dryness and heat of the air have taken the moisture out of the leather, and also the natural oils that were originally a part of the leather, with the result that the trace of sulphuric acid remaining after the tanning was quite inactive so long as the moisture was left in the leather, but by the excessive dryness of and heat of library air the acid became much more acute and active, and soon destroyed the leather, thus making it crumble into powder. Every large library has many thousands of dollars worth of leather bindings that have been ruined in this way by the atmospheric conditions due to a lack of proper ventilation on the one hand, and to some extent modern methods

---

* *"Ventilation, Temperature and Humidity,"* The Trained Nurse and Hospital Review, *November,* 1928.

*The Journal of the Society of Arts, *London, of July* 1 *and November* 29, 1901, *contain important reports on the subject of leather for bookbinding. Douglas Cockerell, the well-known authority on bookbinding, contributed an article to* The Journal of the Society of Arts *of March* 30, 1900, *on the same subject.*

of tanning on the other. To a lesser degree private libraries in homes suffer in the same way when there are many handsome leather bound volumes. This difficulty may be obviated somewhat by treating the leather of the book bindings every few years with proper oils or grease to maintain the natural condition of the leather—quite an expensive performance.

In my office, on the wall where I can always see it, I have a thermometer and a hygrometer, which so far as that particular building is concerned, gives me at a glance some idea of the atmospheric conditions of the building. The air is humidified by exhausting steam into the plenum fan chamber. The effort is made to keep the relative humidity of the building during the winter months in the neighborhood of 50%. This degree of humidity will not ruin the furniture, and will not lead to undue frosting and dripping of the windows, except in bitter cold weather, when it may be necessary to reduce the humidity to about 40%.

I have seen library buildings where the relative humidity in bitter cold weather was down to less than 10% —drier than the driest of our deserts. Engineering problems of conditioning the air so as to get the proper degree of humidity are in process of satisfactory solution, if not entirely solved already. The main thing is to have janitors and firemen in the building who will watch conditions, for no building can be kept in a wholly satisfactory condition without constant and intelligent care and watchfulness.

FILTERED AIR

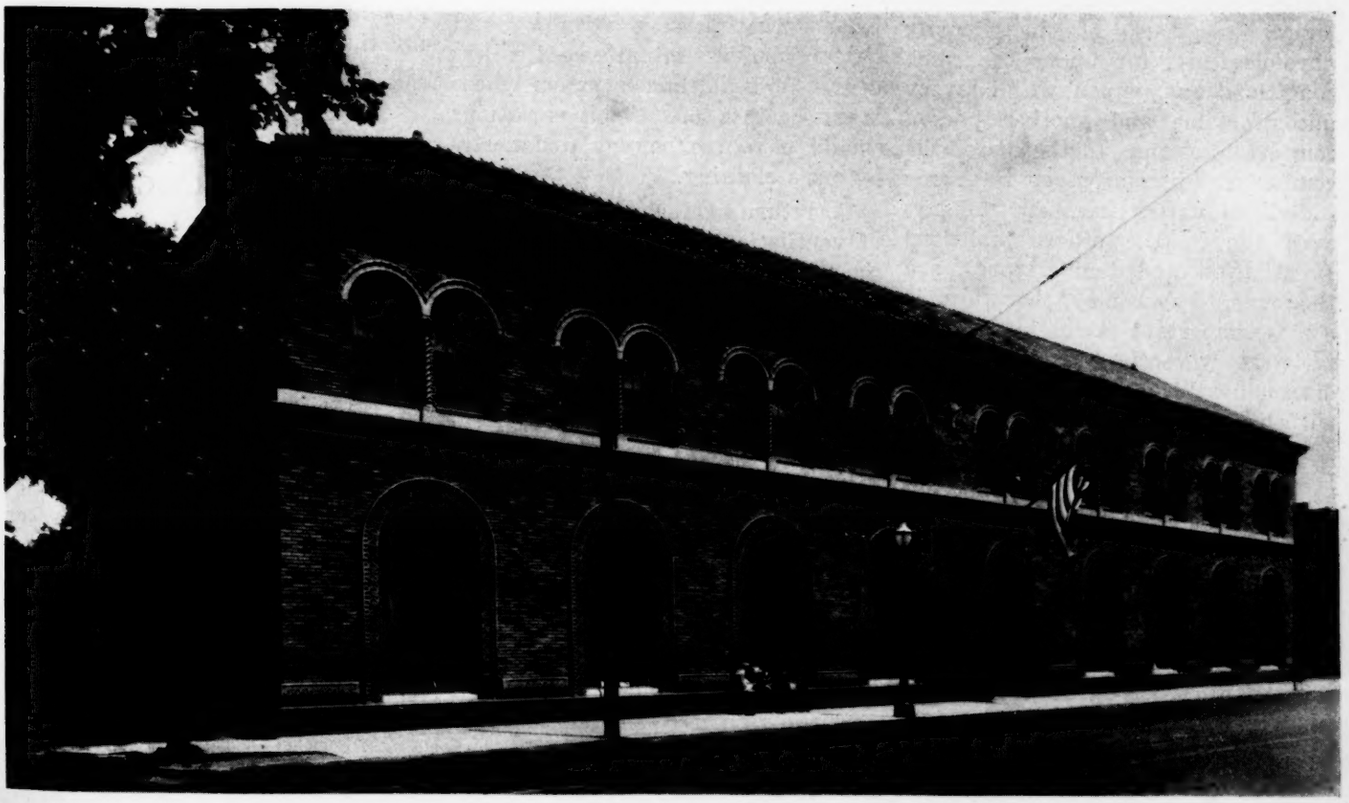
In recent years in many of our cities the problem of smoke, dust, and dirt has been greatly intensified due to the fact that much more soft coal is being used than was the case before the War, so that it is necessary in such cities to tackle the problem of filtered air to keep out smoke and dirt, or reduce them to the lowest possible terms. Smoke and dirt injure books just as they injure walls and building decorations, and are especially harmful to manuscripts and prints.

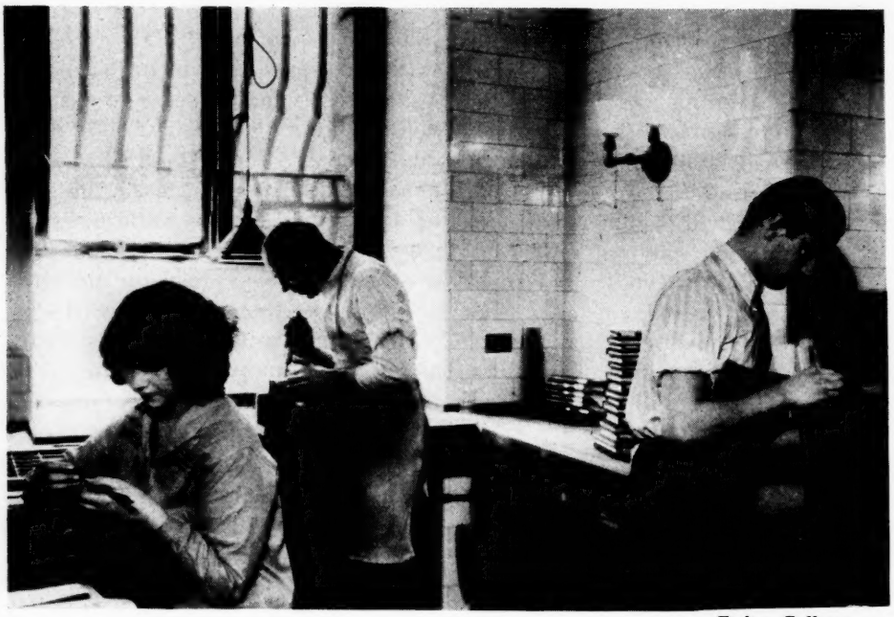
A number of air filtering devices are on the market for both large and small buildings. Within the last few months a relatively inexpensive air filter has appeared which may be attached to a window, so as to use outside or recirculated air. It is especially adapted for a small library. I am convinced that both for the sake of the people in the building (and especially those who must handle the dusty, sooty books) and for the sake of the books themselves, a good system of air filtration is highly desirable, and in many of our cities very necessary. Good air filtration also means less cleaning and painting, thus reducing maintenance costs. The New York State library at Albany has recently installed air filters for its interior bookstack (without windows or doors open directly to daylight) with most satisfactory results.

PHYSIOLOGY AND PSYCHOLOGY OF VENTILATION

But let us return to the primary problem of ventilation which has to do with the comfort or discomfort of persons in the building. This problem is essentially a physiological one, because heat, humidity, odors, lack

West Side Branch of Grand Rapids Public Library with a Capacity of 80,000 Books. Ventilation of the Storage Stacks is by Exhaust Fans so as to Reduce Dampness in the Summer





Ewing Galloway

Finishing Room in the Bindery of the New York Public Library. Much of this Work is Made Necessary by Improper Air Conditions which Ruin the Bindings

of motion in the air, all affect the physiological functioning of the human body. It is these things that cause comfort or discomfort, as the case may be, and therefore greatly affect the amount and quality of work that may be done by individuals in the building, or in the long run may even injure their health.

When the atmospheric conditions in the building result in comfort we say the ventilation is good. When they result in discomfort we say the ventilation is bad. But here enters another problem, namely, the psychological one (also at times partly physiological), for under the same conditions one person will be very uncomfortable and another person comfortable, and furthermore the comfort or discomfort of the same individual varies from day to day, even though the other conditions (ventilation and temperature) are the same. Psychology, therefore, is a most important factor in securing satisfactory ventilation. In fact, in discussing this phase of the subject with librarians of some of the largest public libraries of the country, I find that they are convinced that psychology is at least 50% of the factor of producing satisfactory ventilation.

For one reason or another a worker may come to the library in the morning, feeling more or less uncomfortable, with a poor circulation, hands and feet cold, with dyspeptic manners and generally miserable, while working in a room with a temperature of 75° or 80°, whereas the same person under other psychological or physiological conditions, is entirely comfortable with a temperature of 65° or 68°. What is the library to do under such circumstances? I have been in schoolrooms where an anaemic teacher, of uncertain age, could not be comfortable with a temperature less than 80°, while at the same time the little children, more or less active, were suffering from the extreme heat. Different persons are also affected differently more or less regularly. As a general proposition I believe that persons with a heart beat of 80 per minute need a less degree of heat than a person whose heart beat is 60. Such variations should, of course, be regulated mostly by one's clothing.

To return again to the psychology of ventilation. If a person sees all the windows closed with no evidence of air coming into a warm room he is likely to feel hot and uncomfortable and the psychological effect is likely to be bad; whereas, if windows are apparently open, or colored ribbons or colored strips of paper (so as to be readily seen) at the vents through which the air comes into the room are in vigorous motion, the psychological effect is good. I know of one library that produced the psychological effect without its affecting the ventilation in the slightest degree by having a small electric fan blow the ribbons from the vent out into the room, although the air that was being blown did not come from outside of the building at all, but from the same room, and in a way that it really affected the occupants of the room very little, if at all.

In this connection let me quote from an authority on the subject:*

"If I were a psychologist, I would be able to tell the reason why human beings react so differently under similar conditions. The following experience may be of interest. Artificial ventilation in a room with windows closed or in a room without windows will cause frequent complaints. Complaints of poor ventilation stopped after a small flag or string was tied to the duct in a room without windows. Whenever the ventilating fan was stopped for repairs, complaints of headaches were made because the flag or string would hang down. As it became necessary to make extensive repairs to the blowers, the writer secured a fine wire to the string which thus stood out from the inlet or supply duct, as if the moving air held it out. When this became known it was necessary to install a small propeller rotated by the incoming air. Visual evidence of ventilation seems to satisfy. During the week repairs were made, no complaint of lack of air was made."

VENTILATION A HUMAN PROBLEM

The whole problem of ventilation, in short, is a very human problem, and as already indicated it is a problem of ventilating people rather than ventilating buildings, and we all know that people are variable creatures, more or less temperamental, regardless of the degree of temperature. For this reason no library or institution can depend wholly on automatic, mechanical devices to get entirely satisfactory results. Good horse sense, with an understanding of the whole problem, both mechan-

* *"Use of Air Filters in New York Public Library," by John H. Fedeler, Chief Engineer of the New York Public Library.* Journal of American Society of Heating and Ventilating Engineers, *November*, 1926.

ical and human, must be applied, and often for satisfactory results a certain amount of diplomacy.

Most of our public library buildings in the winter months are too warm. People come into them with their winter wraps on, while the employees of the building, mostly women, dressed in the present styles (very little clothing below the knees, and the arms bare to the elbows and above), will be cold, when the people who come in from the outside are uncomfortably warm. Wearing of smocks on the part of employees, encouraged as a clothing saving device, helps to solve one aspect of the psychological problem. The problem is how to get satisfactory conditions for both these groups—employees and public.

When a room is too warm it affects the action of the skin and the heart, unless the air is in vigorous motion, for the air in vigorous motion will aid in evaporating the moisture from the human body, thus tending to reduce the temperature, and to that extent improve ventilation. That is why we have electric fans in summer —the moving air causes greater evaporation from the skin—a cooling process.

However, there may be too much motion in the air, resulting in unduly chilling the occupants because of rapid evaporation. This explains the results of the school ventilation studies of the New York Ventilation Commission which reports larger absenteeism because of respiratory illness in fan ventilated schoolrooms as compared with natural ventilated rooms. This means that there is a danger in too much air being blown into a room.

TEMPERATURE AND ODORS

The problem of odors is greatly intensified by raising the temperature above 68°. A room may be comfortable and satisfactory to everyone in it with a temperature of 66° or 68°, but if you raise the temperature, other things being entirely the same, to 72° or 75°, in a room crowded with people, especially where there is a considerable number of the unwashed, human odors become very noticeable. The higher the temperature above 70° the greater this problem of odors. Keeping the temperature down reduces the problem very materially or entirely eliminates it. It improves the ventilation, and aids in the psychological problem on the part of the public who protest if there is any evidence of fresh air coming into the room from the windows. It has been our experience, in the newspaper and magazine rooms particularly, that there are many more criticisms from readers who object to too much air or too much ventilation rather than not enough.

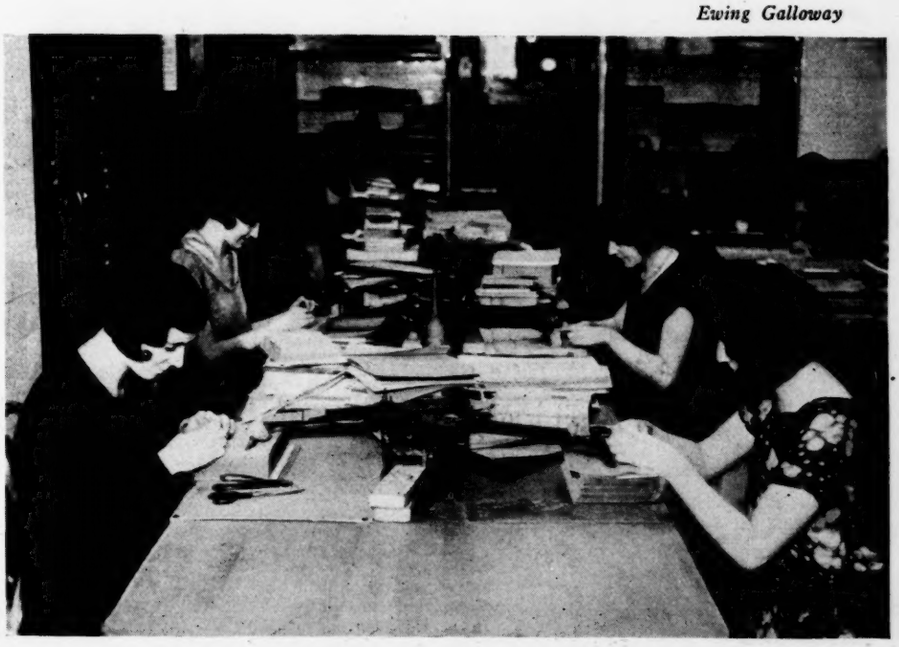
INTELLIGENT OPERATION NECESSARY

The primary problem of ventilation, therefore, is that of controlling conditions of temperature, humidity, odors, and motion of air so that the human body, the heart, lungs, and the skin will function to the best advantage, for health on the one hand and efficient work on the other. To bring this about, any kind of ventilating machinery requires constant observation and intelligence on the part of one or more persons in every large library building. In all too many of our libraries, not to mention our school buildings, and other buildings, the ventilation service is a problem because of improper operation on the part of the janitor or engineer in charge.

Such machinery or apparatus should be made as simple and as nearly fool-proof as possible, so that it may be efficient without undue and unnecessary expense. I have seen many thousands of dollars worth of ventilating apparatus unused in buildings because of the expense of operation, particularly the expense of unnecessary fuel which was required to heat the air to a comfortable temperature, only to blow it all out of the building every 12 minutes with no service to anyone, thus wasting immense quantities of heat and power, all of which waste is exceedingly costly. Under the old theory of ventilation recirculation of the air was taboo. Under the new theories air is being recirculated in large quantities, to the advantage and satisfaction of everyone, and at a very great saving of fuel, for the recirculated air retains its heat. Good results are being obtained with a 75% recirculation.

Every room in a library building should be equipped with a good thermometer, and there should be in the building one or two hygrometers. A self-registering thermometer properly placed is always a good investment to check on the heating plant and the fireman every minute of the 24 hours. In a large public library building an anemometer should also be added to test occasionally the amount of air being brought to and delivered to the various rooms, so as to be sure that

Ewing Galloway



Hand Sewing in the Repair Department of New York Public Library. Saving a Book that is Badly Wrecked is a Tedious Task

everything is functioning properly. When there is a high degree of human intelligence used in looking after these things, even with relatively poor machinery or apparatus, excellent results may be achieved, whereas the most expensive or up-to-date apparatus may prove a failure because of the lack of intelligent operation.

FUTURE OF LIBRARY VENTILATION

A word about the future of library ventilation. In years past we have thought of ventilation primarily in connection with heating, and in the older type of ventilating systems ventilation was a vital part of the heating system. Under this conception ventilation was a winter problem almost entirely. The time is here when we should regard ventilation as a process of *air conditioning*, conditioned and controlled for all kinds of weather, in every kind of climate, every day of every season of the year. This will mean cooling the air and reducing its humidity in the summer or when climatic conditions make it desirable, in addition to what ventilation now does in winter. Some of our industries, especially the textile industries, have made great strides in the use of conditioned air for *things*. It paid in dollars and cents. We are just beginning to realize that it will also pay, and pay well, to condition air for the sake of *people*. Physical comfort, vigor, alertness—all make for morale and personal efficiency in one's work, and air conditioning may make these things easily possible for workers in libraries every day of the year.

WHEN DOCTORS DISAGREE

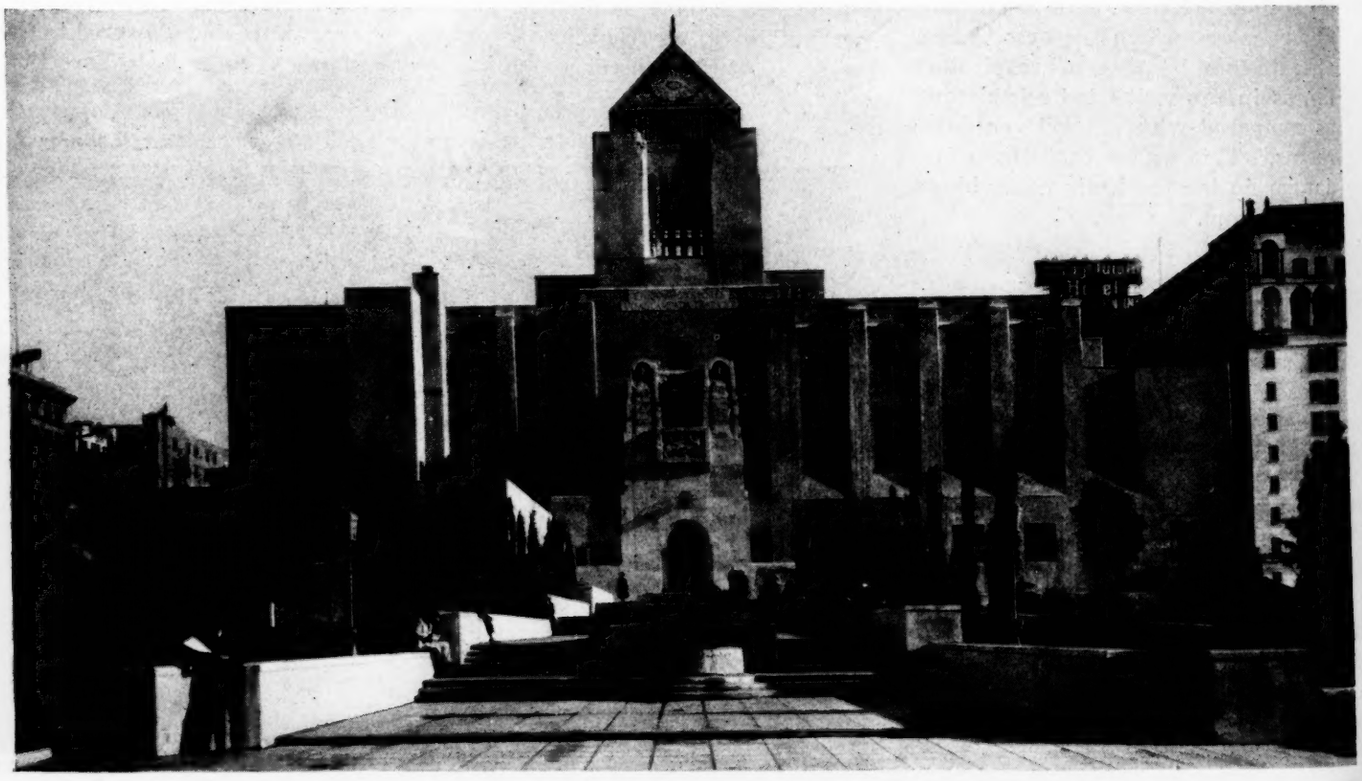
The physiologist and the doctors may not yet wholly agree on what is "optimum" ventilation, and what ventilation really does in a physiological way. For example, is a stationary temperature more or less healthful than a fluctuating one? In ventilating a building should we systematically change the temperature from time to time so as to break up the monotony of an absolutely uniform temperature all the year round? Most people like a change of scene and climate; why not a change in temperature at certain hours during the day?

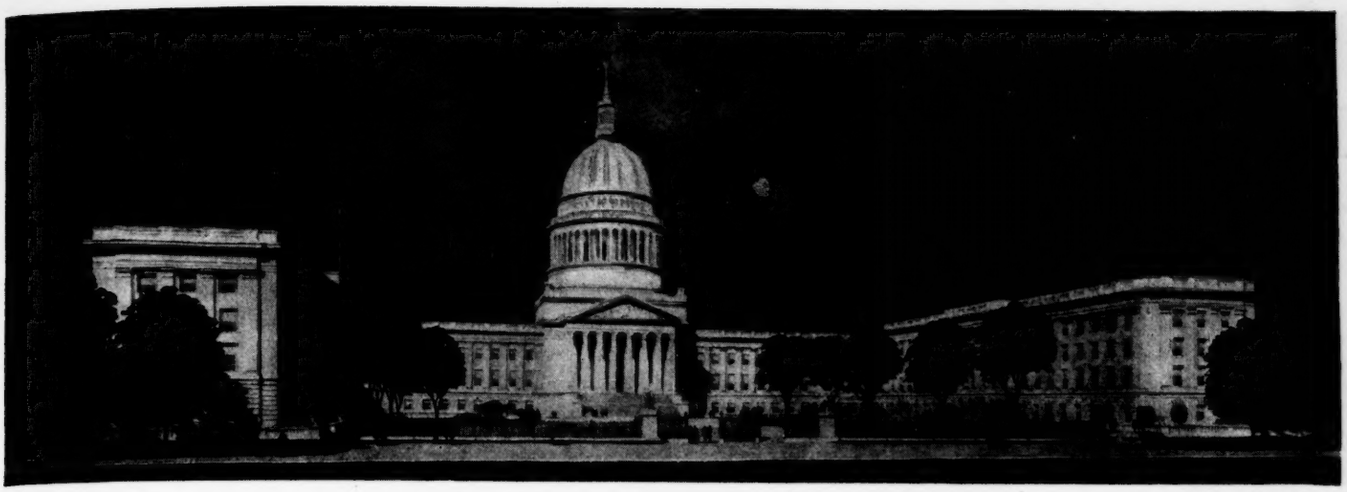
Tests and experiments made by the New York State Commission on Ventilation are extremely valuable studies in many directions, but there is still more or less disagreement about certain of the reported results, some of which were laboratory experiments rather than tests under the regular working conditions of a building as it functions in its routine work from hour to hour through the week. The engineering profession could readily solve and improve the conditions if once the medical profession and the physiologists were to agree on what is the best thing to do.

However, very great progress has been made and conditions are much better than they were 20 years ago. The old theory was satisfactory in keeping down the carbon dioxide content, but since we know that that is not the real test of ventilation, we still have the physiological problem not yet wholly solved. As soon as that is solved I am convinced that the engineering problems will be easily solved. In the meantime, all of us responsible for the operation of library buildings should study our problem, keep records of conditions and results, and thus be able possibly to aid in the solution of a most difficult though none the less a most important scientific and human problem.

Egyptian Architecture is a Feature of the Los Angeles Public Library

Ewing Galloway





West Virginia State Capitol, Charleston, West Virginia — *Cass Gilbert, Architect*

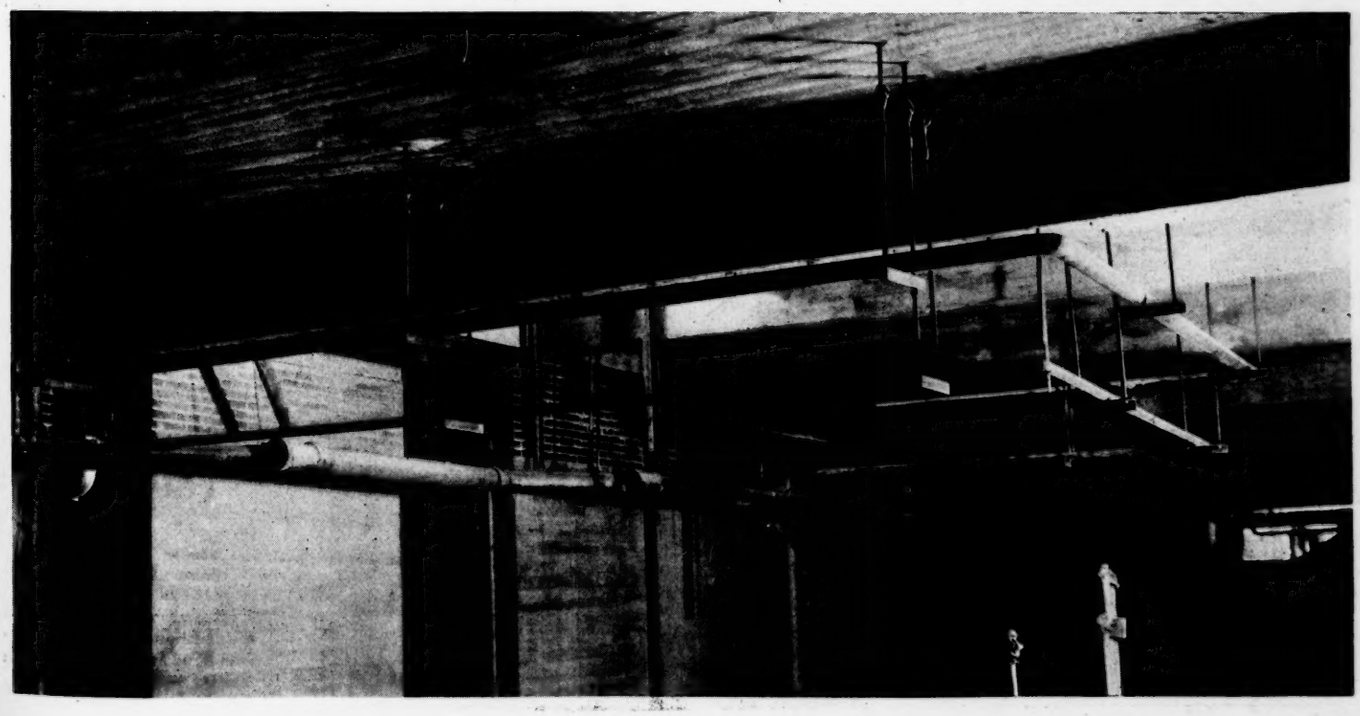
Modern Piping and Humidity Control Features of New Capitol

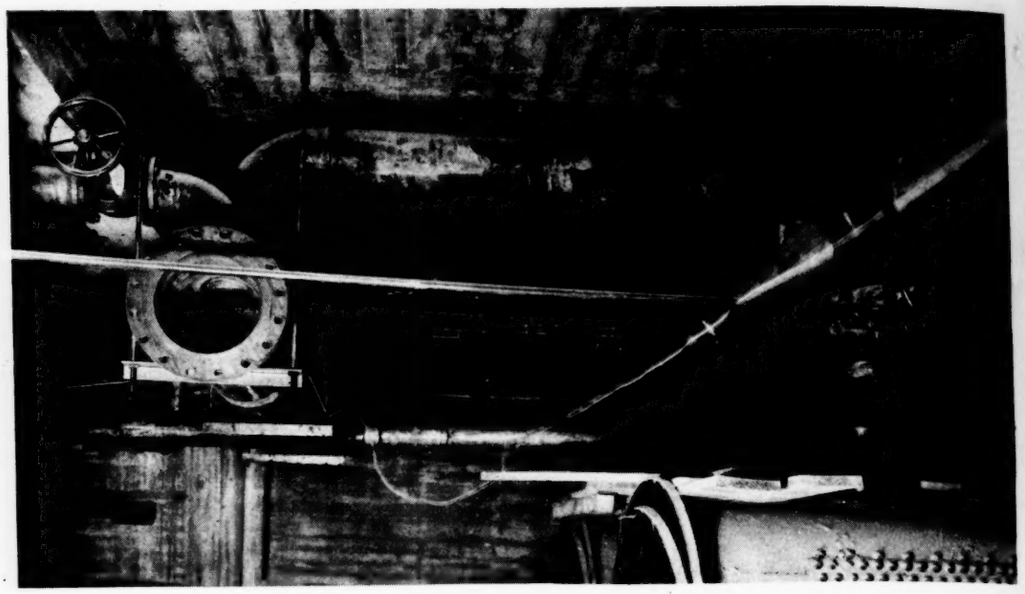
by* Samuel A. McGuire

THE West Virginia State Capitol Group, designed by Cass Gilbert, is located in Charleston, West Virginia, and consists of three buildings, the first of which, the Administration Building, was completed in 1925, and is occupied by the various departments connected with State administration. The second building, known as the Judicial Unit, completed in 1927, houses many departments of the State, and also contains a supreme court room, anterooms, etc. These two units, also known as Nos. 1 and 2, are four stories and basement in height, and measure in plan about 120 ft. x 300 ft., over central portion. The main building, now under construction and approximately 60% completed, measures in place 112 ft. x 550 ft., and is three stories high, exclusive of

**Chief Mechanical Engineer, Office of Cass Gilbert, New York.*

Offset Around Elevator and Machine Room





View of Rear of Boilers Showing Main Header with Steam Leads.

the dome, which rises from the center, directly over the rotunda, to a height of about 250 ft. above grade, and is about 98 ft. in diameter.

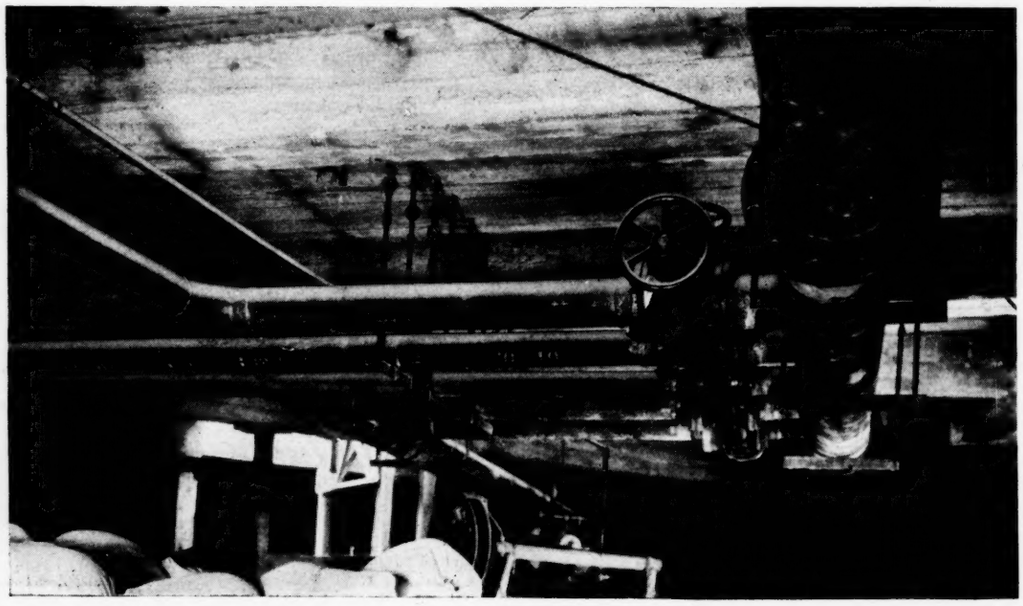
Connecting wings tie the main building to the other two buildings heretofore mentioned. The building has a basement, first, and second stories, and is largely given over to offices and the Governor's private suite. It has four elevators. On the easterly end is the house chamber, and on the westerly end, the senate chamber. The building is wholly of fireproof construction, and of classic design, with limestone facings.

Heating and ventilating equipment is operated by two firebox boilers, each having a heating surface of 2328 sq. ft. The boilers are provided with full automatic equipment for burning natural gas as a fuel, which has a thermal value of 1100 B.t.u. per cu. ft., the gas pressure being 8 oz.

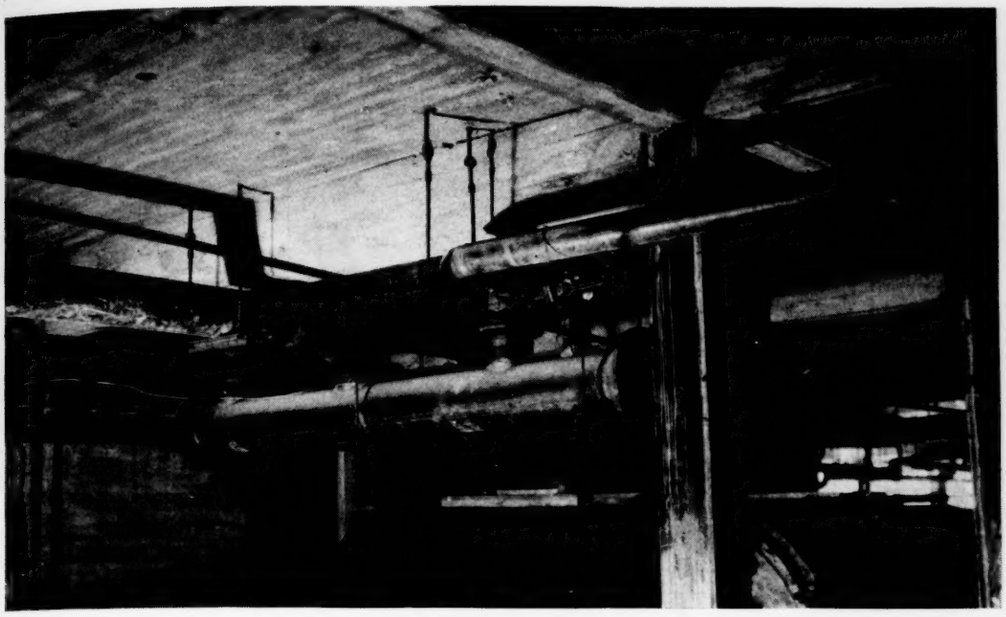
The piping system is divided into four zones; starting with a main header at the boilers, the main supply is carried therefrom to a distributing header, placed approximately at the center of the building, from which the four mains are taken and carried around in individual circuits for all direct heating, a separate supply being run to each of the indirect groups.

The system has been arranged so that a uniform temperature will be maintained throughout the building without either overheating or underheating, and without the consequent waste of fuel caused by opening the windows, which is so frequently the case when the temperatures are uncomfortably high. This is accomplished by circulating the steam at a variable vacuum so that the steam temperatures, and consequently the heat output of the radiators, can be continually adjusted to meet requirements.

Each zone has a separate and individual steam supply and return line with a controller and vacuum pump connected with each zone. Each set of thermostats and controllers will operate the sub-atmospheric reducing valves and each pump in such a manner as to maintain the proper amount of vacuum, thus insuring the correct



Distributing Header in Center of Building Feeding Four Zones with One Line.



Sixteen-Inch Main Header at Rear of Boilers.

steam temperature for each zone, and therefore providing a requisite amount of steam to heat the building as a whole at 70°.

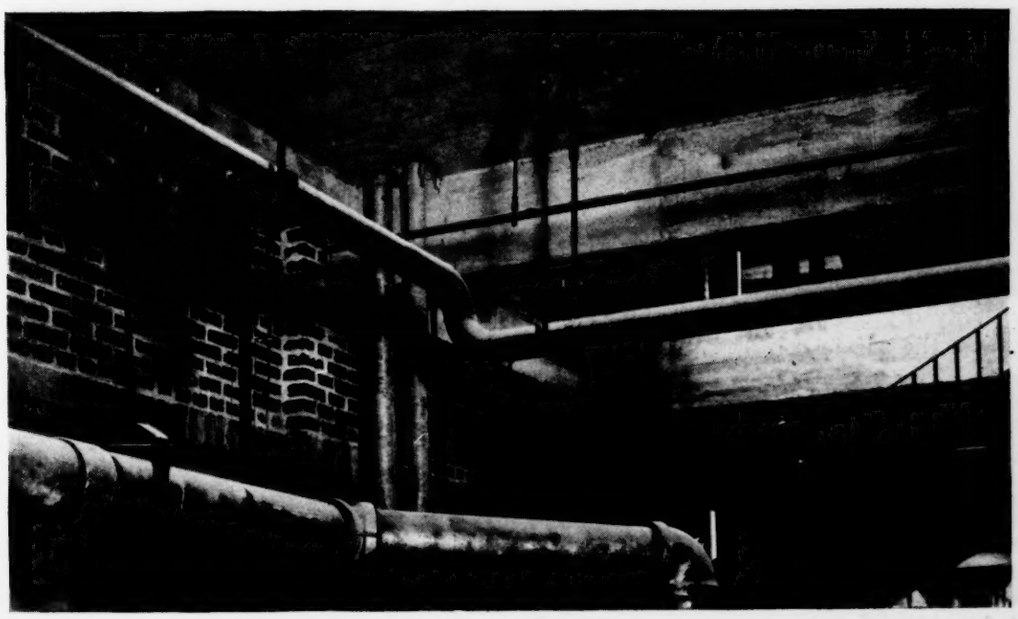
On the control panel, located in the engineer's room, will be connected the thermostats controlling the zones, thermostats being located at each of the four corners of the first floor. On the same board will be signal lights of different colors indicating to the operating engineer the temperature condition in the various parts of the building. It is expected, with this system, that a very radical reduction will be made in the amount of fuel used, as compared with the usual standard type vacuum system, and at the same time maintain a comfortable temperature for the occupants.

Piping throughout is of copper alloy—¼ of 1% copper. All piping, with few exceptions, is gas-welded. The exceptions generally are that, unless the connections vary two sizes or more, they have the usual fittings, as in field work it does not seem feasible to weld such connections, which are too close to each other in size. Tube-turns have been used for all changes in direction, thus insuring uniform strength and uninterrupted flow of steam throughout the system.

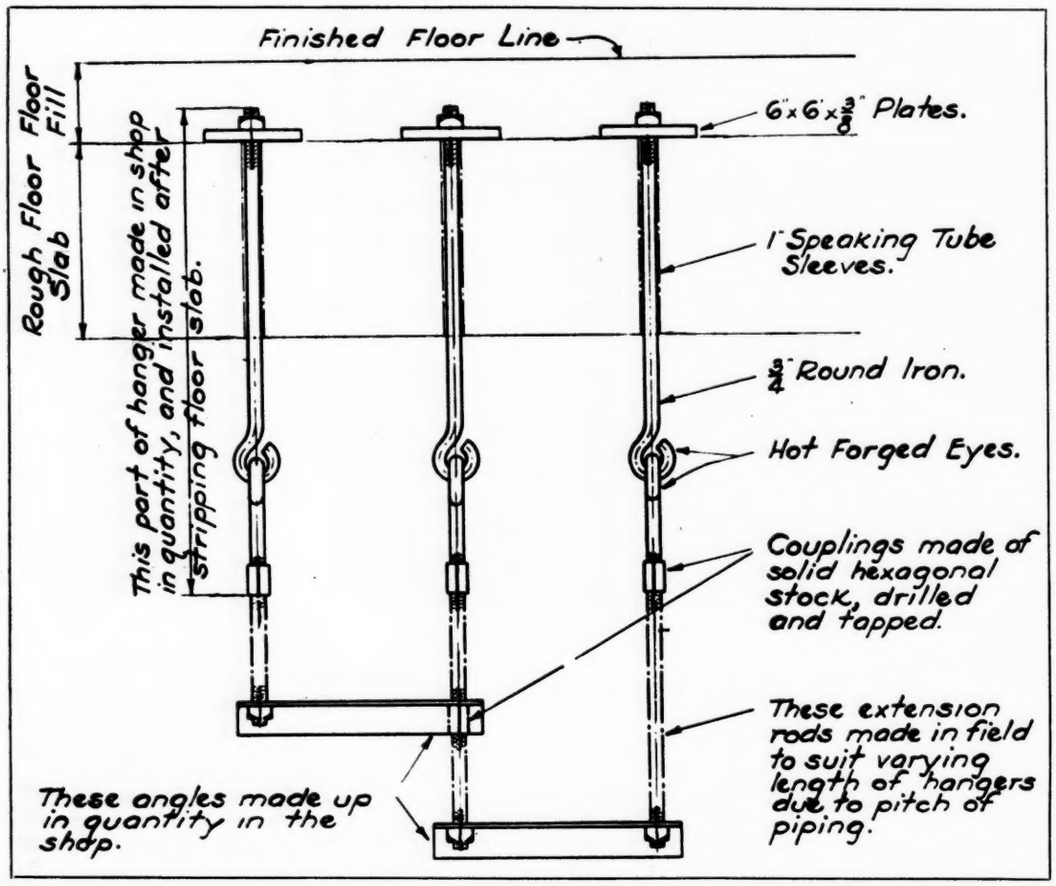
Pipe hangers used in the building are rather different in design and construction from the usual type used. The following letter from the contractor expresses his views on their advantages over the standard make.

"This is a distinct improvement over any regulation hanger for this type of work that we have used or seen. It is well known that on 'roller type' of hangers the rollers do not roll, and the idea of double forged eyes is a welcome solution of the problem of expansion and contraction.

"The hexagonal coupling is used to avoid the confusion of unknown lengths in the lower end of the ¾-in. rod. This is a great advantage from the contractor's standpoint and in no way impairs the efficiency of the hanger. Thus, the entire upper part, as indicated



Rise and Drip at Stairway Showing Welded Pipe with Tube-Turns.


Finished Floor Line
Rough Floor Slab
Floor Fill
This part of hanger made in shop in quantity, and installed after stripping floor slab.
6"x6"x3/8" Plates.
1" Speaking Tube Sleeves.
3/4" Round Iron.
Hot Forged Eyes.
Couplings made of solid hexagonal stock, drilled and tapped.
These extension rods made in field to suit varying length of hangers due to pitch of piping.
These angles made up in quantity in the shop.

Pipe Hangers Used in Capitol Building.

on the sketch, becomes a standard product, and can be made up in quantities for any particular job. With fixed center to center rods, the angles become standard and can be made up in quantities.

"The only operation left for the workmen is to cut and thread the straight ¾-in. rod to suit conditions. The entire upper part of the hanger, including plate, nut, double eye bolt and hexagonal coupling cost approximately $1.00 each, the additional coupling approximately 20c each, and the angle cost averaging 33c, depending on its length. Straight rod, nuts and labor cost approximately $1.00 per double hanger."

The hangers consist of steel rods, ¾-in. in diameter, with the usual floor arch-washers resting on the top of the arch and supporting the hangers and piping. The lower ends of the upper sections have welded eyes into corresponding eyes of the lower section. These are ordered in standard lengths, the lower sections being coupled to the upper sections and the lower ends threaded and provided with nuts and washers. The angle-iron on which the pipes rest can also be ordered in standard lengths, thus making necessary the only adjustment at the couplings. These, as will be noted by the contractor's statement, are very inexpensive and great labor-saving devices. The accompanying drawing will illustrate the points referred to.

VENTILATION ARRANGEMENT

Ventilation for the house and senate consists of two complete units comprising paper filters attached to removable frames and of the requisite number of units to clean the amount of air passing through them; two banks of copper fin type heaters; all-copper washers with double sprays and flooding nozzles; humidity control, consisting of closed-heater, reverse-acting diaphragm valve, dewpoint thermostat, necessary air piping, etc.; two banks of reheaters of same type as the preheaters; the supply fan, duct work, registers, etc., all of which are located in the basement.

The ventilating system has been designed to supply the air generally at the ceiling and discharge downward —a downfeed system. Velocities of the air are therefore rather higher than would ordinarily be used with the usual arrangement. This was done for the purpose of creating a gentle but positive downward pressure, so as to reach the breathing line effectively.

Exhaust air is drawn through step grilles and carried down to the exhaust fan in the basement and discharged through the roof. The fresh air intake on the west side is carried up to the roof and the air drawn in at that point. That of the east side is somewhat differently arranged, in that, after reaching the roof, the intake duct is carried south approximately 60 ft. and terminates in the usual louver arrangement. This was done for the purpose of avoiding gases from the stack, the prevailing winter winds being approximately southwest. The section of the duct above the roof is of heavy lead-coated copper carried on steel construction, and serves two purposes—one for the main fresh air supply to the house and the other for the boiler supply, the duct being provided with a partition for dividing the proper amount of air for boilers and ventilation. No supply air is recirculated.

DUCT WORK INSULATION

In order to avoid transmission of air noises, a rather unusual precaution was introduced, which consists of insulating ends of the ducts at every other length, or

about 16 ft apart. The usual steel angles are riveted to the ends of the ducts, and a ¾-in. strip of felt was placed between the angles bolted together with rubber washers under the head and nut. These were all drawn up tightly so that there would be no air leaks, and also so that metal would not touch metal. The strap hangers supporting the horizontal runs of ducts were split; that is, made in two sections and bolted together with rubber insulation. With these precautions, there is every assurance that there will be no sound transmission from air.

Fans and motors also have extra heavy foundations and are insulated with four inches of compressed cork between layers of 6 in. x 8 in. timbers. The discharge velocities from the fans are very low, so that it is expected that there will not be the slightest noise in the system.

Plates or sheets of galvanized steel making up the duct work are, excepting in the very small sizes, buckled diagonally, thus giving extra strength and rigidity to the ducts.

TEMPERATURE CONTROL

Temperature control is arranged in the "step" method, excepting the first section of preheaters, which is hand controlled. The balance of the sections are all thermostatically controlled, and supplied by the usual steel tank and duplex set of compressors. The system also operates the reverse-acting diaphragm valve, which is controlled by a dewpoint thermostat. Duct thermostats are provided to control both the incoming temperature and also the final temperature of the air leaving the fan discharge.

Hygrometers are provided with metal charts for quickly ascertaining the relative humidity from the dry and wet bulb readings. An ample supply of thermometers is provided for checking the air and water temperatures.

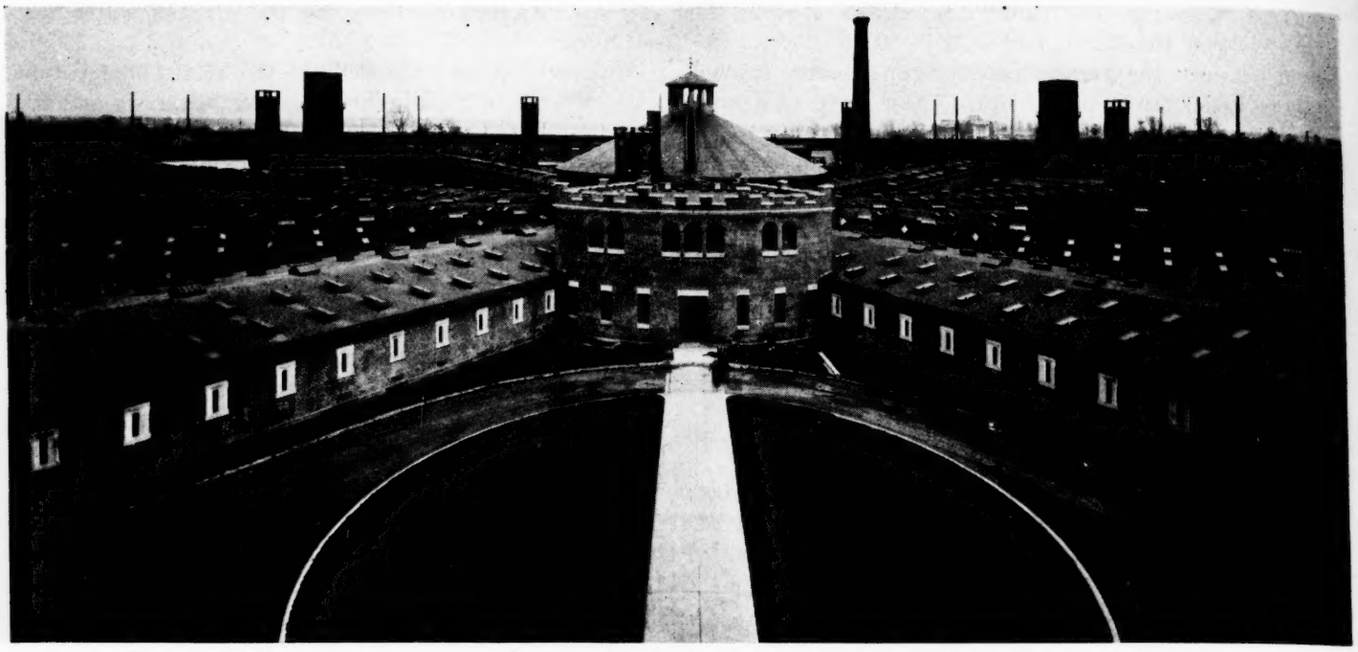
Humidity control consists of the closed-heater type, with reverse-acting diaphragm valve, which is actuated by air pressure and guided by the dewpoint thermostat. It is expected that a dry bulb temperature of 68°, with a relative humidity of 45%, will be maintained.

CONTROL PANELS

Panels controlling the fan motors are arranged with nine steps from 100% to 50% of normal. The panels are also equipped with circuit breakers and watt-hour meters for measuring the current consumption of each unit.

Air supply and exhaust systems have been designed on an occupancy basis, and arranged for ample flexibility. The entire heating load is about 30,000 sq. ft. indirect, and approximately 26,000 sq. ft. direct, inclusive of the mains and risers. The heating load on the first unit amounts to about 16,000 sq. ft., and on the second unit, approximately 22,400 sq. ft. The originally contemplated scheme was to have the group of three buildings supplied with steam and probably electrical energy from a power or boiler house located at approximately 1100 ft. from the group, and the feeding lines brought to the buildings underground. However, pending the construction and completion of the boiler or power house, each unit was equipped with what might be considered temporary heating boilers, thus making each building a self-contained and independent unit.

Expansion Joint in Twelve-Inch Steam Main. One Leg is Twelve Feet in Length and the Other Seven Feet



A County Prison near Philadelphia. Fresh Air Inlets for Heat Units Are Shown Under the Cell Windows

Fin Type Radiation as Used in Public Institutions

by* G. Kendrick Bringhurst

DURING the past five years, the use of tubes and fin radiation has become more and more common in the heating of buildings. The writer has used it in the mechanical design for a number of public institutions, in places where cast iron radiators would not have been so acceptable because of their greater dimensions and weight. At first, there was some hesitation in using this new type of radiator due to the uncertainty of its lasting qualities as compared to cast iron, as to the tightness of its connections, and other details of construction, but these objections appear to have been overcome and at present there are any number of different makes on the market which are being used successfully.

In this type of radiation, the heating elements or fins have extended surfaces made of copper, brass, aluminum, steel and other metals, either attached to or made integral with the core containing the heating medium. Contact between the fins and core is made by brazing, welding or soldering, or by pressure, or by a combination of both.

The heating units are usually installed at the base of a vertical stack with inlet and outlet grilles. Heating is entirely by convection and the amount of radiation supplied is dependent upon the difference in weight of the air column within and without the stack, the higher the stack the more radiation supplied. Fin type radiators are also known as convection heat units.

Stacks are usually built of galvanized sheet metal, well stiffened, anchored to the wall construction, and generally insulated. The area of the stack should, if possible, correspond to the effective area of the unit, and in no case should be less than 60% of the area. Grilles should have a free area of not less than 50% of the area of the unit.

Where the inlet and outlet grilles are located in the same room a circulation of air through the unit is assured, but when the inlet air is taken from below the floor of the room to be heated, it is necessary that a circulation be maintained in this space below, otherwise there will be no circulation through the unit. Again, if fresh air is taken through a duct with inlet in the outside wall of a building, it is important to remember that with the wind on the opposite side of the building there will be poor circulation through the unit, as the pull of air in this case will tend to be in the opposite direction.

The following is descriptive of fin type radiation as installed in different types of public institutions.

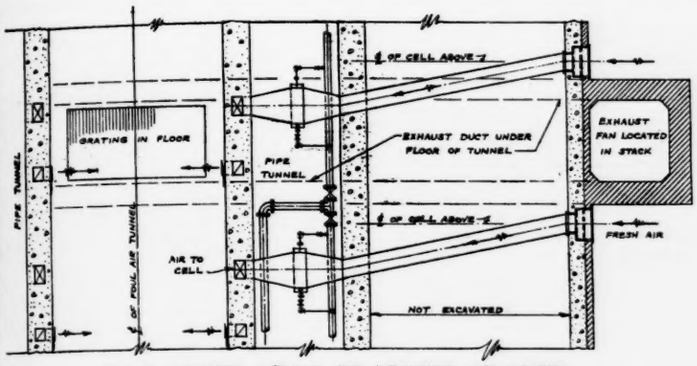
COUNTY PRISON

In the two most recent wards of a county prison, the cells are heated by fin type radiation located in the pipe tunnels below the cells.

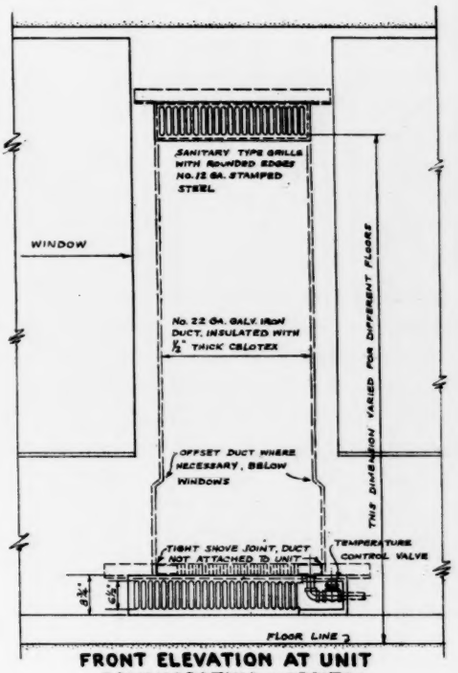
Each ward is 180 ft. x 26 ft. and contains 72 cells 8 ft. x 16 ft. x 10 ft. high, and 4 other end rooms, including one for showers, one story in height. The cells are located on each side of a central corridor.

Each cell has a fresh air intake duct located under the floor with an inlet grille in the outer wall. Air is

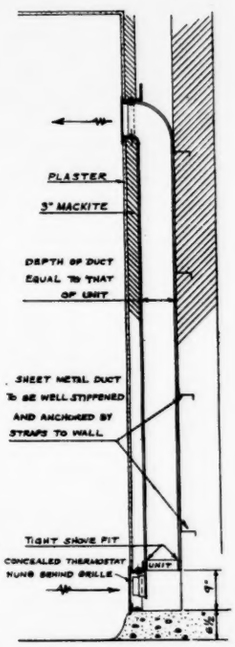
**Consulting Engineer, Philadelphia, Pa.*



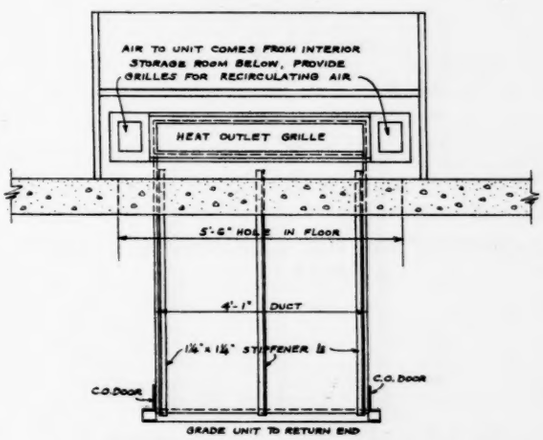
PLAN UNDER CELLS AT CENTER OF WARD
COUNTY PRISON


SANITARY TYPE GRILLS WITH ROUNDED EDGES NO. 12 GA. STAMPED STEEL
WINDOW
No. 22 GA. GALV. IRON DUCT, INSULATED WITH ½" THICK CELOTEX
OFFSET DUCT WHERE NECESSARY, BELOW WINDOWS
TIGHT SHOVE JOINT, DUCT NOT ATTACHED TO UNIT
TEMPERATURE CONTROL VALVE
THIS DIMENSION VARIED FOR DIFFERENT FLOORS
FLOOR LINE

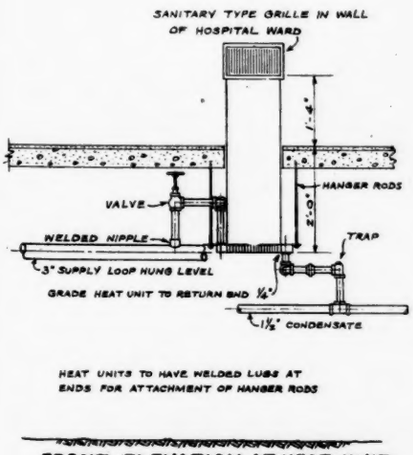
FRONT ELEVATION AT UNIT
PSYCHOPATHIC HOSPITAL


PLASTER
3" MACKITE
DEPTH OF DUCT EQUAL TO THAT OF UNIT
SHEET METAL DUCT TO BE WELL STIFFENED AND ANCHORED BY STRAPS TO WALL
TIGHT SHOVE FIT
CONCEALED THERMOSTAT HUNG BEHIND GRILLE
UNIT

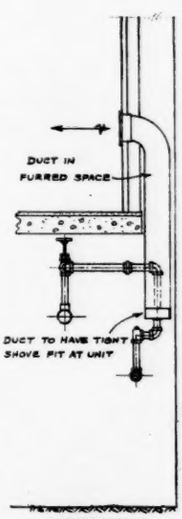
SECTION THRU UNIT
PSYCHOPATHIC HOSPITAL


AIR TO UNIT COMES FROM INTERIOR STORAGE ROOM BELOW, PROVIDE GRILLES FOR RECIRCULATING AIR
HEAT OUTLET GRILLE
5'-6" HOLE IN FLOOR
4'-1" DUCT
1⅛" x 1⅛" STIFFENER
C.O. DOOR
C.O. DOOR
GRADE UNIT TO RETURN END

ELEVATION AT SEATS IN WAITING ROOM
PSYCHOPATHIC HOSPITAL

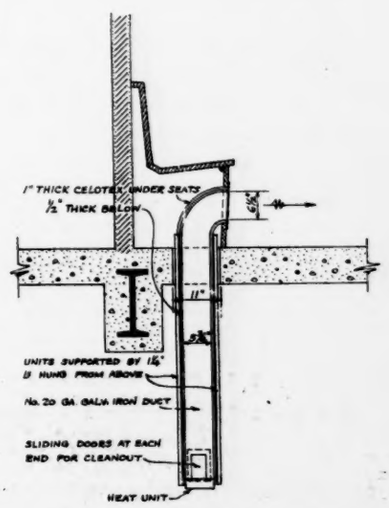

SANITARY TYPE GRILLE IN WALL OF HOSPITAL WARD
HANGER RODS
VALVE
WELDED NIPPLE
TRAP
3" SUPPLY LOOP HUNG LEVEL
GRADE HEAT UNIT TO RETURN END
CONDENSATE
HEAT UNITS TO HAVE WELDED LUGS AT ENDS FOR ATTACHMENT OF HANGER RODS

FRONT ELEVATION AT HEAT UNIT



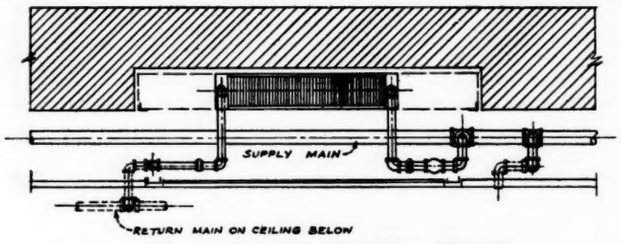
SECTION

TUBERCULOSIS HOSPITAL, COUNTY PRISON

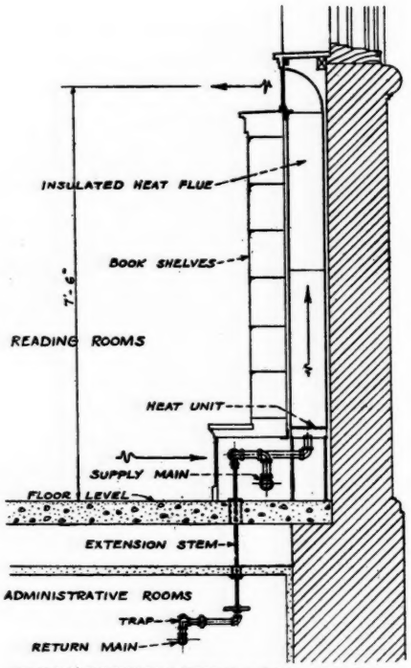

1" THICK CELOTEX UNDER SEATS ½" THICK BELOW
UNITS SUPPORTED BY 1¼" Ø RUNS FROM ABOVE
No. 20 GA. GALV. IRON DUCT
SLIDING DOORS AT EACH END FOR CLEANOUT
HEAT UNIT

SECTION THRU SEATS IN WAITING ROOM
PSYCHOPATHIC HOSPITAL

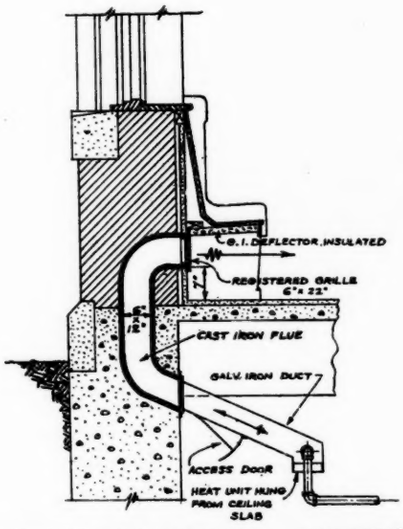
Details of Light-Weight Radiation Installations in Public Buildings



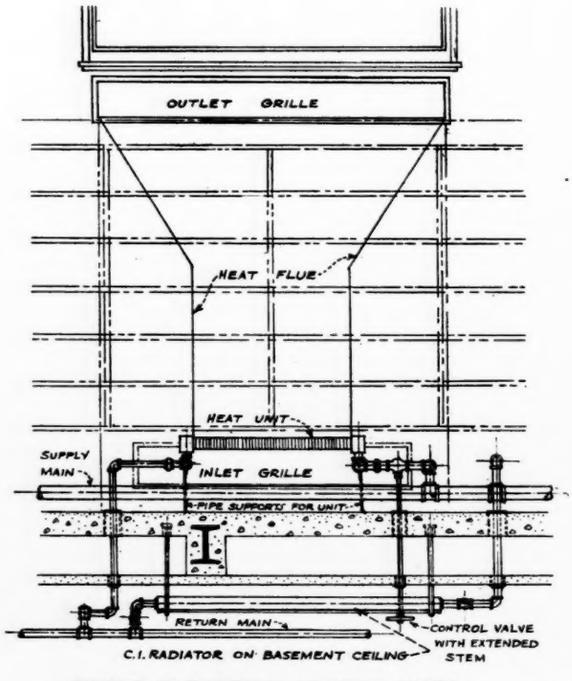
PLAN AT BASE OF BOOK STACKS
LIBRARY



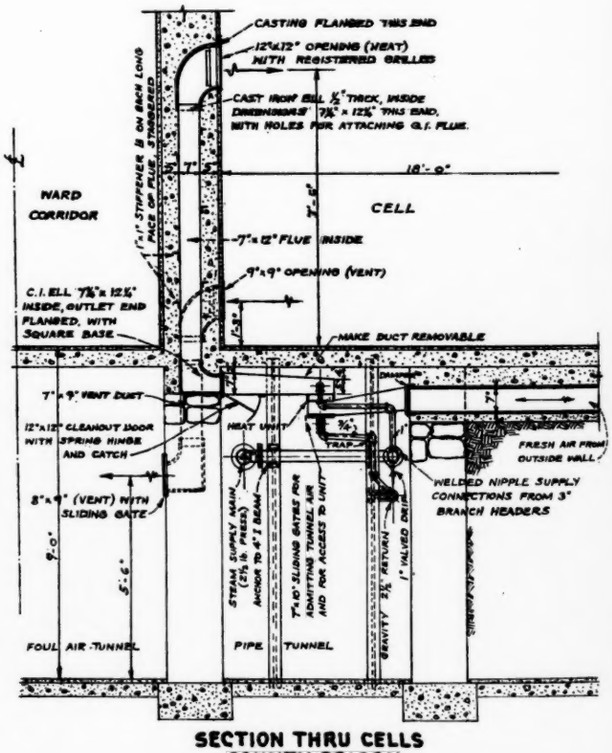
CROSS SECTION THRU BOOK STACKS
LIBRARY



SECTION THRU BENCHES IN VISITORS' ROOM
COUNTY PRISON



FRONT ELEVATION AT HEAT UNITS
LIBRARY


CASTING FLANGED THIS END
12"x12" OPENING (HEAT) WITH REGISTERED GRILLES
CAST IRON SILL ½" THICK, INSIDE DIMENSIONS 8" 7⅞" x 12⅞" THIS END, WITH HOLES FOR ATTACHING G.I. FLUE.
1"x1" STIFFENER 8 ON BOX LONG FACE OF FLUE STUDDED
7"
18'-0"
WARD CORRIDOR
7'-6"
CELL
7"x12" FLUE INSIDE
9"x9" OPENING (VENT)
C.I. ELL 7⅞"x12⅞" INSIDE, OUTLET END FLANGED, WITH SQUARE BASE
MAKE DUCT REMOVABLE
7"x9" VENT DUCT
12"x12" CLEANOUT DOOR WITH SPRING HINGE AND CATCH
HEAT UNIT
TRAP
FRESH AIR FROM OUTSIDE WALL
8"x9" (VENT) WITH SLIDING GATE
WELDED NIPPLE SUPPLY CONNECTIONS FROM 3" BRANCH HEADERS
9'-0"
5'-6"
STEAM SUPPLY MAIN (2½ lb. PRESS.) ANCHOR TO 4" I BEAM
7'4 10" SLIDING GATES FOR ADMITTING TUNNEL AIR AND FOR ACCESS TO UNIT
1" VALVED DRIP
2½" RETURN
FOUL AIR TUNNEL
PIPE TUNNEL

SECTION THRU CELLS
COUNTY PRISON

Details of Light-Weight Radiation Installations in Public Buildings

supplied to the unit from this duct or from the pipe tunnel, sliding dampers allowing for either arrangement. The heat supply grille in the cell is located 7 ft. 6 in. above the cell floor. Vitiated air is removed from the cells through grilles near the floor, being pulled down into a large foul air tunnel located between the two pipe tunnels, by a 12,600 c.f.m. exhaust fan. The fan is located at the center of the ward and exhausts up through a vertical brick stack. In winter weather there is a good circulation of air in the cells due to the low outside temperature, but in moderate weather the fan is operated to speed up circulation, and incidentally ventilation.

Prisoners are usually an undernourished lot, and as the prison wearing apparel does not contain much warmth it is important that ample radiation be installed. It is also important that all radiators, piping, valves, etc., be kept out of reach of the prisoners, and the wall grilles be rugged enough to withstand breaking. It is also advisable to provide a good sized cleanout door at the base of the heat flue to each cell. Very often these flues are found to have been stuffed with all manner of debris, even though the grilles remain intact.

Before this installation was accepted, the writer conducted a series of tests of the heat units with gravity circulation and they fulfilled the specified ratings. A total of 9500 sq. ft. of equivalent direct radiation was installed in each ward.

In the visitors' waiting room of the prison, fin type radiation was hung from the ceiling slab of the room below. Heat outlets were located under the benches around the walls of the waiting room, with connecting ductwork from the units.

In the layout for the tuberculosis hospital at this prison the radiator units are placed in the partly excavated space below the hospital wards, there being about 6 ft. 6 in. head room allowed. This enables the operating engineer to have access to the valves and piping serving the heat units, hospital sterilizers, etc., without his having to enter the tubercular wards.

FREE LIBRARY

In the heating installation for a branch of the free library, fin type units were used to heat the large reading rooms. In other libraries of this character, it had been customary to use cast iron radiators located under the book stacks, with the heat ducts discharging behind and over the stacks. Because of the high ceilings and large amount of glass area, and because of the air changes required for adequate ventilation, it was necessary to install plenty of radiation.

Spaces under the book stacks were limited in size, and when cast iron radiators were used it was generally necessary to decrease the required amount of radiating surface because of these space limitations, and even then there was not sufficient space for good circulation.

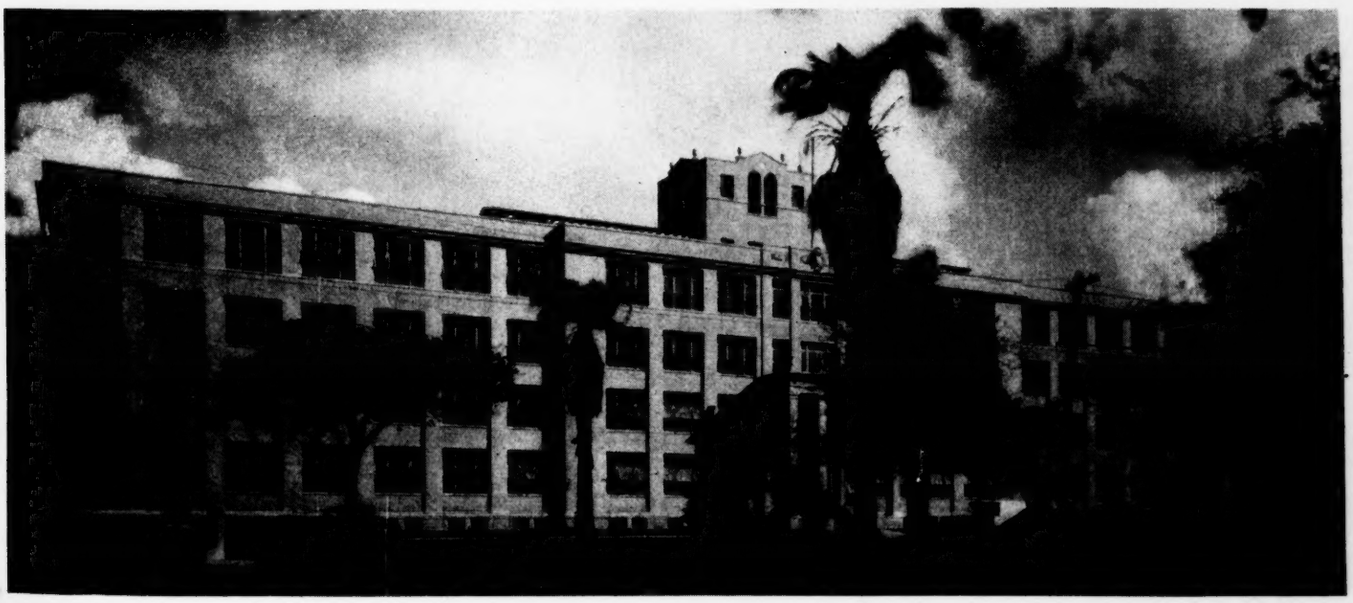
Use of fin type radiation solved this problem, and in addition there was room under the book stacks to run the heating supply main, which had formerly been hung from the ceiling of the administrative rooms below, where it made an unsightly appearance. This method of heating was likewise much more efficient, the fin type radiators being strictly convection units.

PSYCHOPATHIC HOSPITAL

In the design of a hospital building for psychopathic patients, it is imperative that the equipment be inacessible as many of the patients are violent.

Fin type units, totaling about 20,000 sq. ft. of equivalent direct radiation, were used in such a building, being placed between windows in furred spaces in the outer walls, where it would not have been possible to use cast iron radiators because of their greater size.

Automatic temperature control was required, with the thermostats placed where they could not be tampered with. These were located behind the low inlet grilles to the units and adjusted accordingly. No. 12 gauge stamped steel inlet grilles were attached by countersunk brass screws to an angle iron frame built into the wall construction, and the screw heads were painted over for concealment.



Deibert Tubercular Hospital, New Orleans

Design of Mechanical Equipment for an Ice Rink and Dance Hall

by **C. E. Daniel***

DESIGNING a building which is to be used alternately as a dance hall and as a skating rink, brings up numerous problems of heating and ventilation not ordinarily met with in buildings of the conventional type. Such a building is the Casino at Playland Amusement Park, Rye Beach, New York, which is used primarily as a skating rink. It is owned by Westchester County and operated by a concessionaire. The building was designed by Walker and Gillette, architects, and Daniel, Moray and Wallen, consulting engineers, under the direction of the Westchester County Park Commission. It was opened in the spring of 1930 and has been used as a skating rink since October. Walls are constructed of hollow block so as to form an air space in all outside walls. Roof framing is of Lamella construction with a built-up paper roof with wood sheathing.

Approximately 275 ft. x 195 ft., the building is divided into two sections—the skating rink and the restaurant. The heating plant for the rink is independent of the one which serves the restaurant.

In designing the heating systems, the hall was first considered on the basis that it was to be used as an ice rink. Two points were kept in mind in this connection, the first being the comfort of the skaters and spectators, and the second the preservation of the ice. Inasmuch as the temperature desired by the skaters and the temperature desired by the spectators differ considerably, the ideal arrangement would be to separate the rink itself by partitions from the lobby, entrance halls, locker rooms, etc. This scheme was followed so far as the practical operation of the rink would permit.

From the standpoint of temperature, it would have been advisable to separate the section occupied by the spectators from the rink itself by glass walls. Such a system would, however, detract largely from the pleasure of the spectators since, in their enthusiasm, spectators at hockey matches insist on talking to the players and the referees. Consequently, there is no partition between the spectators and the players.

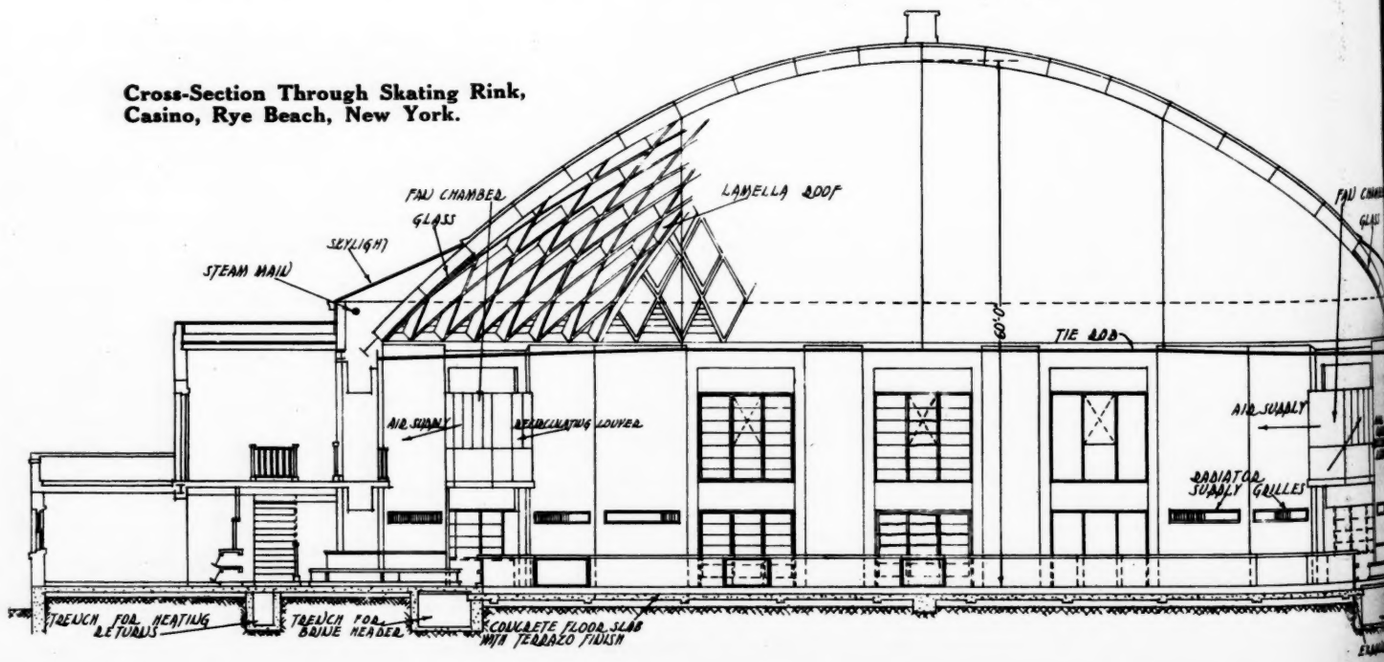
Since the temperature of the ice must be 32° or lower, and since the comfortable temperature for the spectators would be 68°, it was decided to average the two temperatures at 50° as the temperature at which the rink would be maintained. Radiation in the locker rooms, toilets, restrooms, lobby, etc., was installed to maintain 70°.

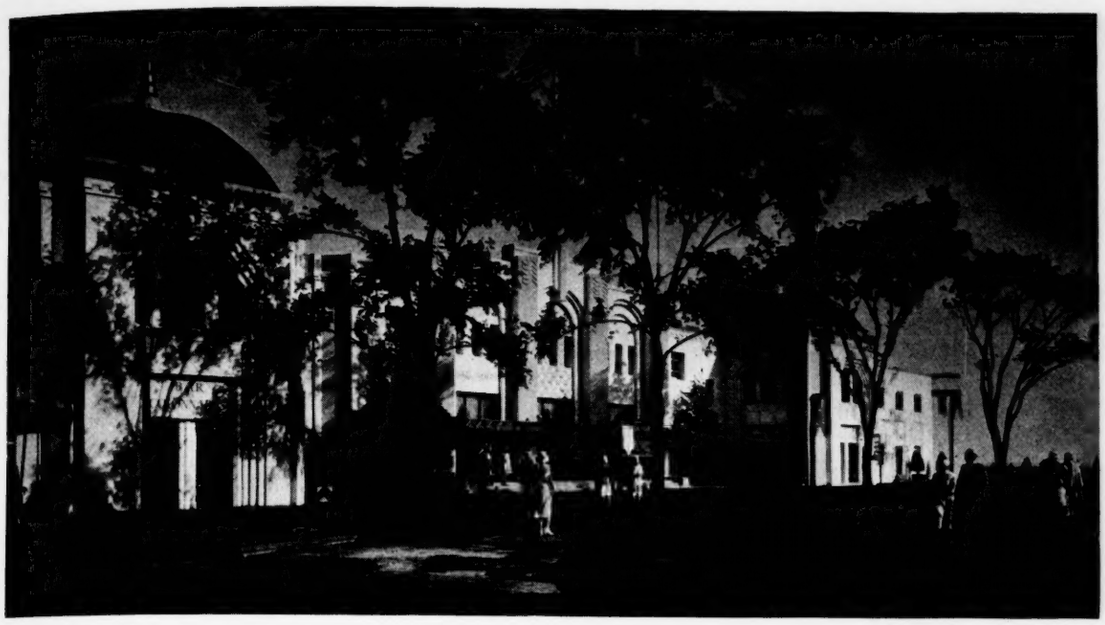
Heat losses and heat gained throughout the outside walls and glass interior partitions between the heated rooms and the rink and the temperature of the ice were considered in determining the radiation requirements. A temperature differential for the heat losses was taken at 50°-0° for outside walls and roof, and as 50°-20° for losses through the ice and terrazzo. The heat gained through the glass and walls next to heated rooms was calculated on the basis of the temperature differential of 20°.

It was determined that the radiation which would be required for the building when used as a dance hall during the winter was more than would be required for the

*Of Daniel, Moray and Wallen, Consulting Engineers.

Cross-Section Through Skating Rink, Casino, Rye Beach, New York.





Casino, Playland, Rye Beach, New York

rink, so that the installation was made to meet this condition.

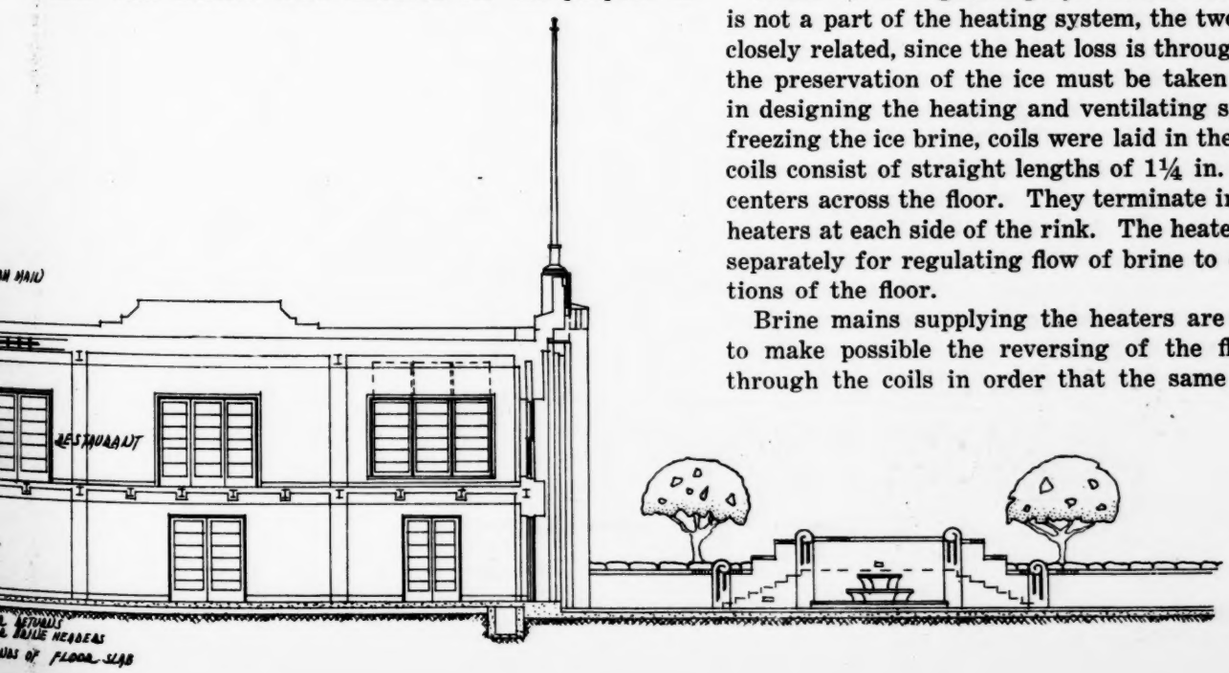
Heat is supplied to the rink in two ways. First, through four blast heaters placed about 15 ft. above the floor in the corners of the building, and second, by direct radiation installed around the edge of the spectators' gallery, which is raised from the rink proper. Approximately 50% of the direct radiation is thermostatically controlled and can also be operated by an air switch at the control board. With this arrangement the excess radiation can be used to advantage when it is desired to raise the temperature quickly.

The temperature of the brine below the ice falls as low as 15°, so that the tendency for the air to stratify in a building such as this, with a high ceiling, is more pronounced than in halls of other types. The lower level of cold air is not disturbed by the normal air current, since it lies in a pit formed by the rink and is protected by the solid guard rails. The four recirculating fans with heaters were installed for the purpose of utilizing the heat in the upper part of the building and to heat the lower strata of air quickly. When snow ice is formed by skates, these fans and heaters are used to drive warm air down to the ice surface to melt the snow and loose particles of ice. After this melting takes place, the fans are shut off and the brine temperature lowered to refreeze the water formed on the ice surface.

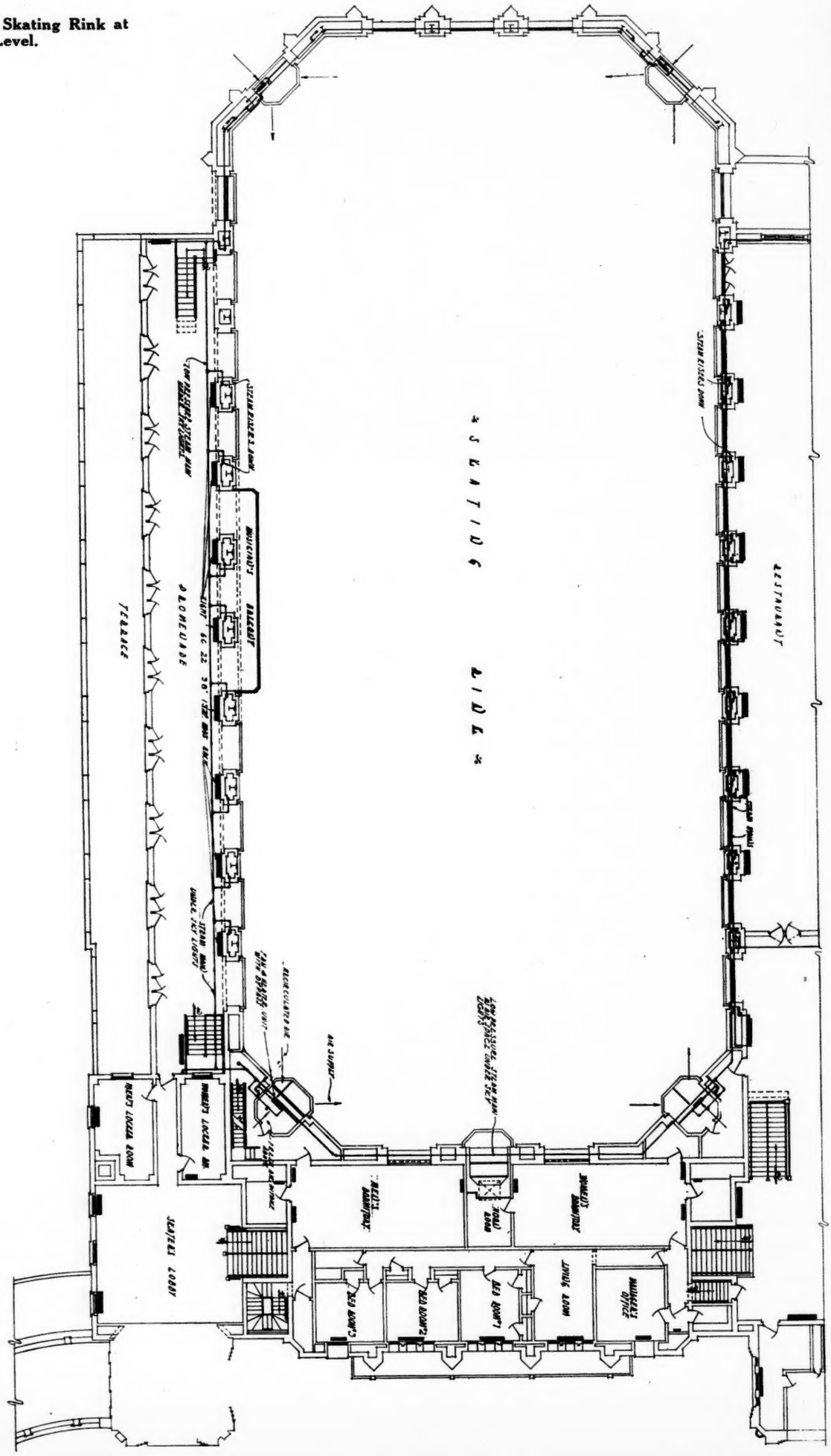
The four fan-driven units are operated by switches on the control board. Two sets of louvers are used, one being for air supply, either cold air or heated air, and the other being used for recirculation. The air connections to the fans and heaters can be closed or opened from the control board so as to recirculate the air or to supply fresh air with the heaters on or off. Larger fans or heaters could have been used to advantage, so far as heating is concerned, but the units installed were selected so as to avoid any possibility of the operator allowing large streams of hot air to melt sections of the ice.

While the refrigerating system for freezing the ice is not a part of the heating system, the two systems are closely related, since the heat loss is through the ice and the preservation of the ice must be taken into account in designing the heating and ventilating systems. For freezing the ice brine, coils were laid in the floor. These coils consist of straight lengths of 1¼ in. pipe on 4 in. centers across the floor. They terminate in 10 cast iron headers at each side of the rink. The headers are valved separately for regulating flow of brine to different sections of the floor.

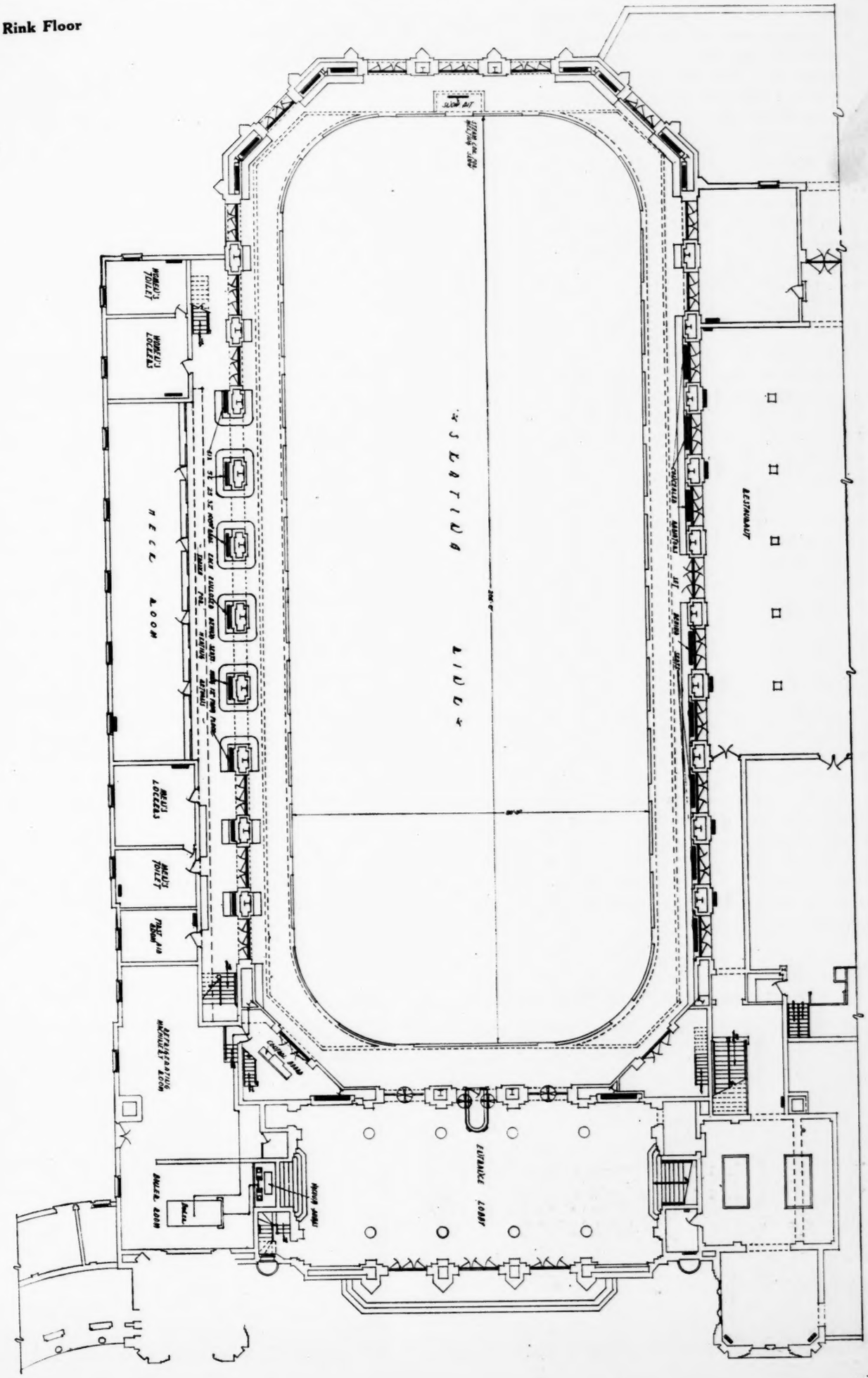
Brine mains supplying the heaters are valved so as to make possible the reversing of the flow of brine through the coils in order that the same temperature



Plan of Skating Rink at Upper Level.



Plan at Rink Floor



may be maintained on each side of the rink. Coils are an integral part of the floor slab and were laid in the concrete forms before the slab was poured. The floor consists of a reversed monolithic slab of concrete terazzo without expansion joint or seams of any description, except at the ends and sides where the slab is free to move horizontally. The rink can be turned into a dance hall by melting the ice and waxing the terrazzo surface.

The control board is located at the end of the rink at the entrance to the boiler and refrigerating room and is of prime importance in maintaining proper temperatures in the building and regulating the temperature of the ice. The board is set in a glass enclosure and is attended by an operator twenty-four hours a day.

Four sets of temperatures are measured in the hall: about 12 ft. above the ice at four points; in the concrete slab under the ice; the temperature of the flow and return brine, and the temperature of the reserve brine supply. All are checked and recorded every 15 minutes. The control board also contains the air switches to operate the louvers in the fan units, and a weather vane for determining the direction of the wind, so that the outside air can be used to best advantage in ventilating the building. Temperatures are taken at the control board with a Cambridge-Paul distant-reading electrically-operated thermometer.

The room temperature and the temperature under the ice are normally maintained at 50° and 20° respectively. When these temperatures vary, the operator can increase or decrease them from the control board. Room temperatures are varied by means of the air switches which control the radiators, fans and air dampers. Ice temperatures can be changed by electrical switches on the board which control the brine circulating pumps and the brine control valves.

The heating system for the rink is of the vacuum type with oil-fired steel boilers. Steam is distributed through an overhead main which is run under the skylight, while the returns are carried back to the boiler room through branches, as it was not possible to provide a basement without excavating below the high water level. A small cast iron boiler, also oil-fired, is used to melt the snow which has accumulated in the ice pit at the end of the rink.

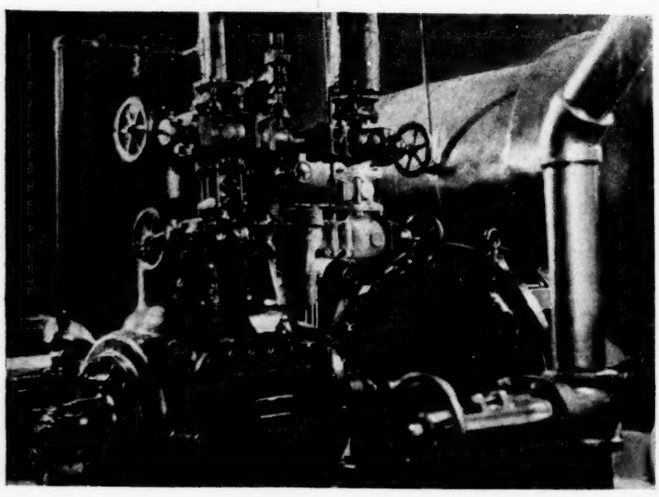
View of Ventilating Louver from Floor

Heat in the hall is shut off entirely during the night and when the rink is not in operation. Toilets, dressing rooms and locker rooms are maintained at approximately 60°.

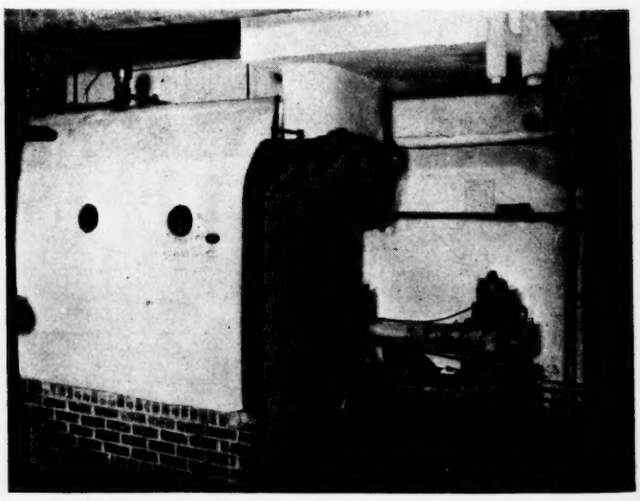
In the actual operation of the rink, the only difficulty that has been experienced is that very warm air has been blown into the rink from the entrance lobby. It appears that this air enters the hall and is drawn down to the ice surface. The open spaces between the entrance lobby and the rink are to be reduced by the installation of additional glass partitions, but it is not possible to close up these openings entirely as turnstiles are used as ticket booths. The problem might have been solved by the use of revolving doors, but the additional cost removed such a method from consideration at the time of design.

Heating of the restaurant which joins the rink is of the conventional type, except that radiators have been installed along the wall which joins the rink so as to provide heat to take care of the heat loss through the walls and glass from the restaurant to the rink.

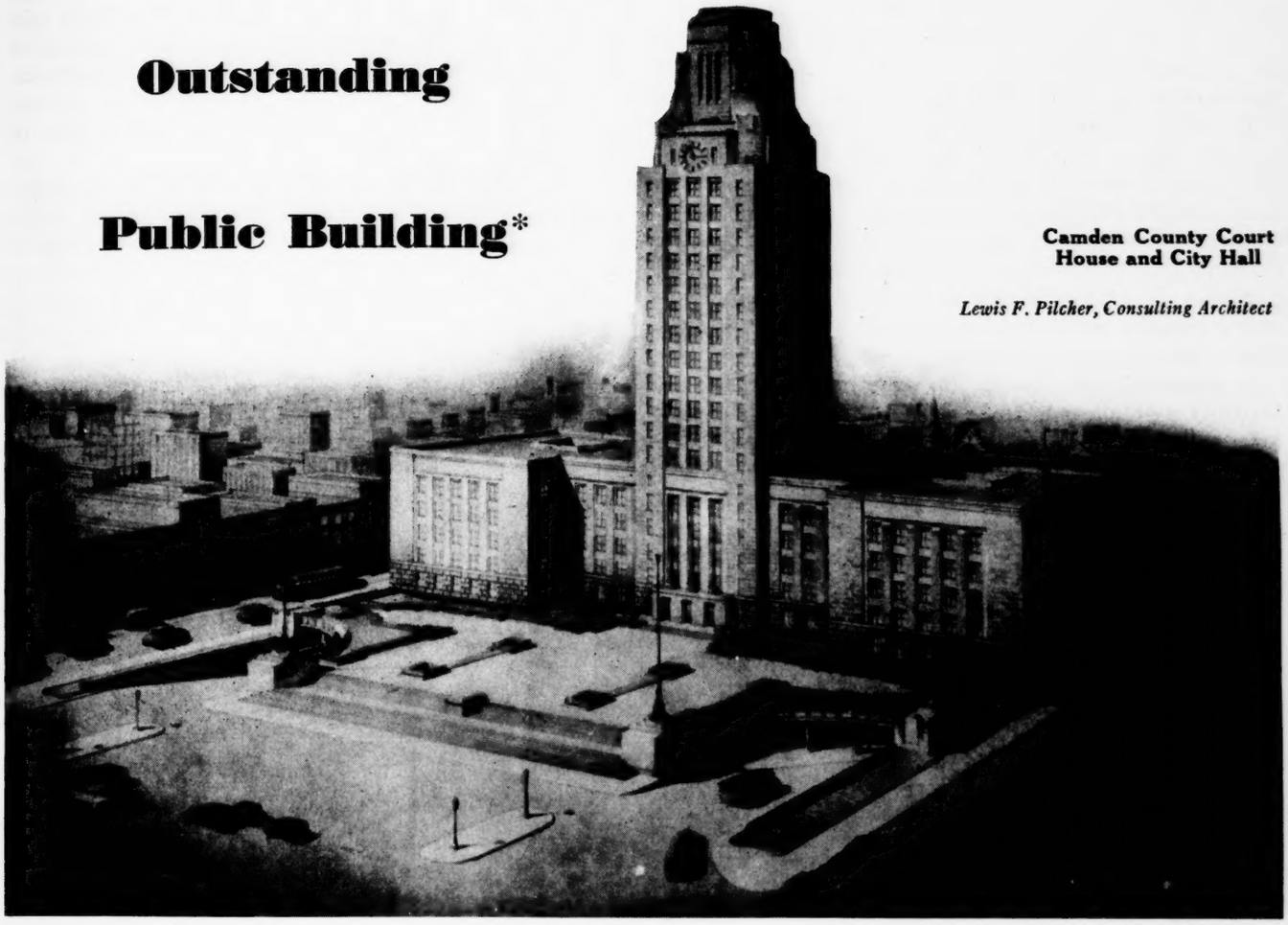
Refrigerating Equipment in Machinery Room



Oil-Fired Steel Boiler in Casino



Heating and Ventilating Design for an Outstanding Public Building*



Camden County Court House and City Hall

Lewis F. Pilcher, Consulting Architect

THE Camden City Hall and County Court House, recently completed, stands as an excellent example of public building, planning and construction. The striking outside appearance of the building is well illustrated in the accompanying photograph. Photographs fail to show the beauty of the interior which must be seen to be appreciated. The main section of the building is five stories in height while the tower rises to a height of nearly 300 ft. above ground level.

The building stands on an extensive tract located in the heart of the downtown district and adjacent to the old county court house. The site was acquired and cleared of existing buildings which were largely antiquated. It is a part of a very extensive proposed development of streets and surrounding buildings which will eventually form an administration center. Located close by are extensive industries and the passenger station of the Pennsylvania Railroad. The approach to the newly completed Delaware River Bridge is within two blocks of the City Hall Plaza.

In order to fully appreciate the general plan of the building and its surroundings, it is necessary to know the local conditions. Camden and Philadelphia are closely linked together in that a considerable number of people commute between the two cities, many being employed in Philadelphia and living in South Jersey. The bridge includes provision for carrying subway tracks which will connect the proposed system of subways in Camden with the existing and projected subway lines in Philadelphia, and over which through trains will be operated. The Camden underground lines will pass the Plaza on which the new City Hall and Court House now stands and will continue underground to the railway passenger stations. Electric surface lines will be depressed near the Plaza and connected by passageways with the bus terminal and Pennsylvania Railroad station.

A new bus terminal, with waiting rooms, stores, restaurants, etc., for which plans are largely completed, will be erected practically integral with the City Hall and Court House Building. The level of this terminal will be depressed with long ramps for the busses. The roof of the bus terminal will form a part of the ornamental approaches to the present building. The accompanying photograph shows how the proposed bus terminal and City-County building will appear when both are completed. Walking subways will connect the bus terminal with the subway system and with the electric surface lines. Thus, in this comprehensive plan provision has been made for all forms of traffic and all traffic facilities have been brought to closely adjacent

**Information for this article obtained through the courtesy of Lewis F. Pilcher, Consulting Architect for the building, and also in charge of City Planning for the City of Camden; formerly State Architect of the State of New York.*

and interconnected locations. Easy transfers can be made between suburban, railway, and inter-city lines. When completed the Camden city plan will be one of the outstanding developments of its kind.

One of the unusual features of the bus terminal is the proposed provision made for its ventilation. Since the terminal is below grade and covered, it is essential that carbon monoxide should not be permitted to accumulate. Large open spaces are provided in the roof of the terminal and it is built without doors. Thus large quantities of outside air can circulate through the enclosure. Provision is also made for connecting the terminal to supply and exhaust fans located in the main building. The terminal will be provided with four lanes with a capacity for thirty busses, with passenger islands located between the driveways.

In designing the heating and ventilating equipment for the City Hall and Court House several unusual features, apart from the bus terminal project, had to be taken into account.

The sub-soil conditions of the Administration Center and surrounding blocks present difficult and very expensive problems in the introduction of sub-basement construction for heating plants. The zoning betterments of the Plaza required the development of a plan that would make possible the elimination, at an obvious saving of money and space for construction, of multi-chimneys and their accompanying smoke and soot nuisance. Too, the requirements for supplying heat to the bus terminal, its concession dependencies, and the adjacent 5th Street subway stations brought into the design of the power plant in the sub-basement of the City Hall-Court House unusual problems of load estimating and locations. To meet these various demands a central heating plant with a capacity to take care of the total dispersed load was designed and installed—the several divisions arranged to be placed in operation as the problems arise. To the load of the Plaza elements it is projected to add the heating of a school, fire station and district police station when constructed within a short distance from the Plaza. The economic value of this municipal prevision when one understands that the major structures to be built in the Administration Lane can be reared without the great cost of difficult sub-basement and construction necessary for the placing of individual power plants—such plants being unnecessary on account of the possibility of purchasing metered steam and also cutting out the annual maintenance of such plants.

Since the building is the only one in the projected group which will contain a high tower through which a stack can pass without marring the architectural

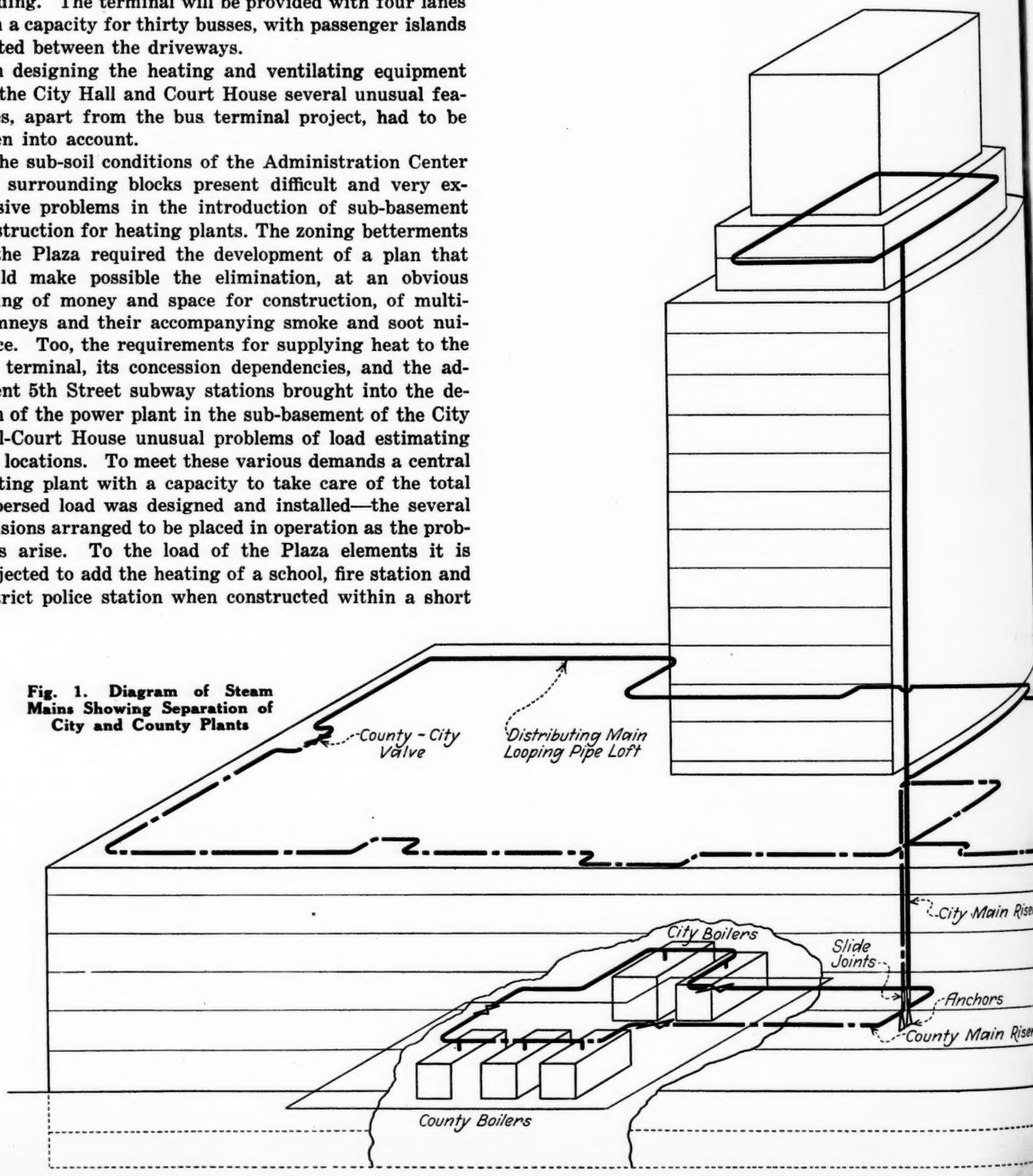


Fig. 1. Diagram of Steam Mains Showing Separation of City and County Plants

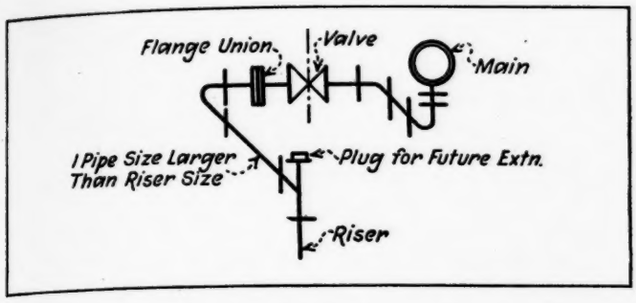


Fig. 2. Detail Showing Connections of Risers to Mains

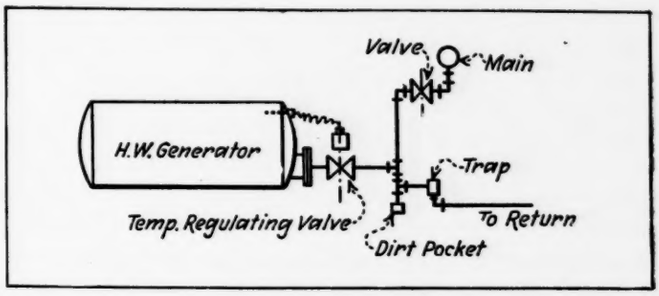


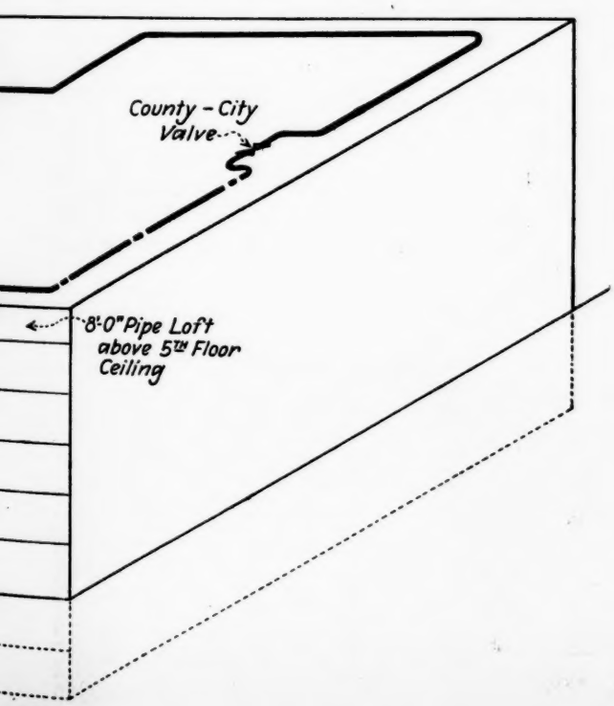
Fig. 3. Piping Detail at Hot Water Generators

effect, it seemed desirable to provide sufficient stack and boiler capacity to let the heating plant in this building act as a central plant to supply heat to the whole group.

The plant design was further complicated by the necessity for completely separating the heating and ventilating and other mechanical equipment of the city and the county. This was necessary in case opposing political parties are in power in the city and county. Furthermore, each division receives its funds from separate sources and each operates independently of the other. Complete separation of the plants seemed the only way to be sure that each division was paying its own costs. Moreover, the county desired to furnish heat to the old court house adjacent to the new building.

The plan of the building is so arranged that all space used for county purposes is in the main body and rear of the building, including the basement and lower six floors. The city occupies the other part of the main building and all of the tower. A corridor extending the length of the building on each floor separates the county space from the city space. As a result the design proceeded substantially as if two separate buildings were being designed having the center line of the corridor as an imaginary party wall. Operating valves were so located that in case of emergency the whole building could be fed with steam from either set of boilers.

A considerable part of the county section of the building is devoted to accommodations for courts, judges, attorneys and attending witnesses. Since much of this space will often be crowded, provision for air supply was necessary in these rooms. The court rooms are beautifully finished and decorated and it was necessary to carefully fit the equipment to the surroundings.



The city portion of the building is largely devoted to office space except for a large room for the use of the public meetings of the City Commission. Ventilation was necessary for this chamber which is also an excellent example of artistic interior architecture. A city-operated radio broadcasting studio occupies an entire floor high in the tower and needed special treatment for sound proofing and air supply.

Connected Load. The total connected load, inside the building and not including the old court house across the street and the hot water generating requirements, is nearly 66,500 sq. ft. of equivalent direct radiation. The total surface is divided into approximately 48,000 sq. ft. of direct radiation and 18,500 sq. ft. of unit ventilator surface, as tested. The city portion of the load amounts to 27,500 sq. ft. and the county portion nearly 39,000 sq. ft. In the city section 5½% of the total load is unit ventilators while in the county portion the unit ventilator load is 43½% of the total. Included in the direct radiation load is 800 sq. ft. of non-ferrous radiation installed on the seventeenth floor of the city portion.

Radiators. Exposed tubular radiators are used in most rooms not specially treated for architectural finish. They are hung about one foot from the floor to facilitate cleaning. In rooms and offices for major officials and in those architecturally treated the radiators are concealed under the windows with grilles set flush with the surrounding walls. Unit ventilators are set both for outside air circulation and for recirculating. Nearly all are recessed in the walls. There is a total of 47 unit ventilators.

Distributing Mains. Fig. 1 shows the method of distributing the steam. The county main leaves the boilers and passes up a pipe shaft to a pipe loft in the top of the main portion of the building. In the loft it connects to a main which circles the loft. Risers are taken from this main and feed downward to all radiators. The city main leaves the city boilers and also rises through the pipe shaft to the nineteenth (or machinery) floor in the tower. A main circles the nineteenth and risers feed downward to the seventh floor. As the main passes through the pipe loft above the fifth floor it branches to feed the city side of the loop.

The mains are welded and long radius bends are used at the turns. The figure shows the loops in the piping in the loft which take care of expansion.

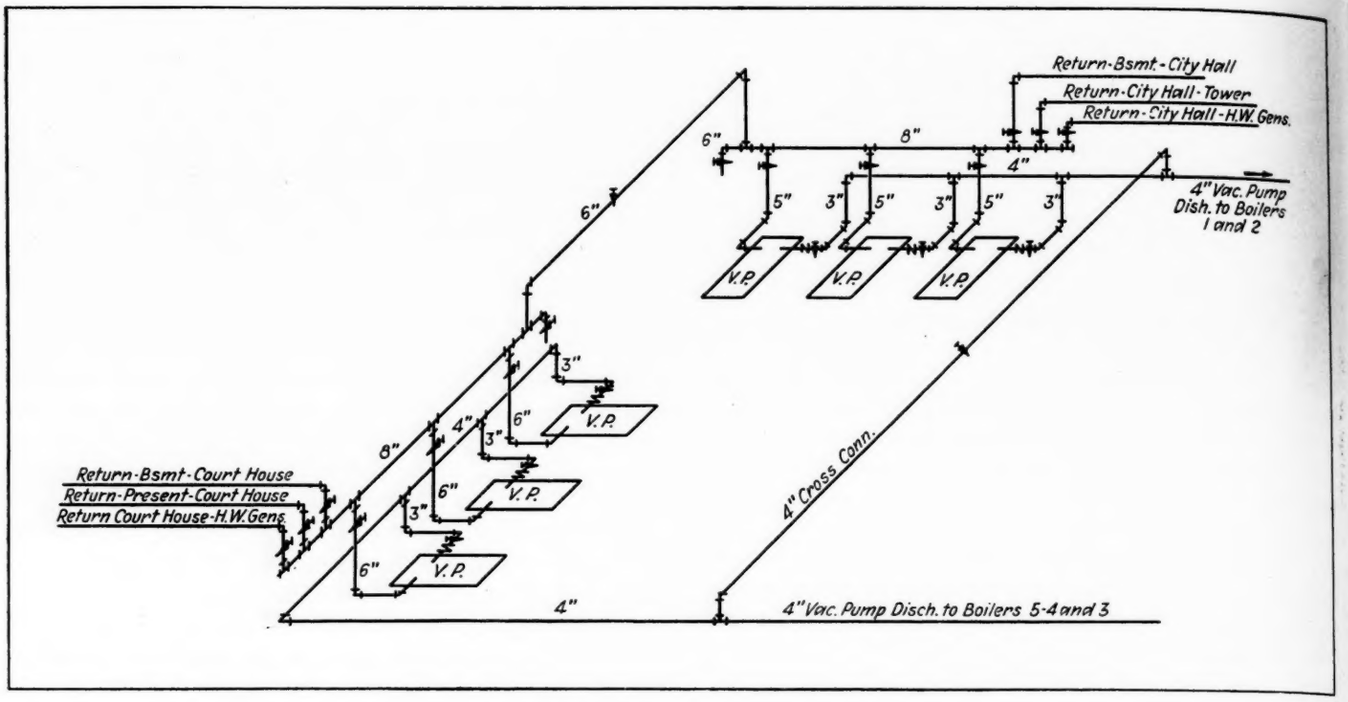


Fig. 4. Detail of Piping at Vacuum Heating Pumps

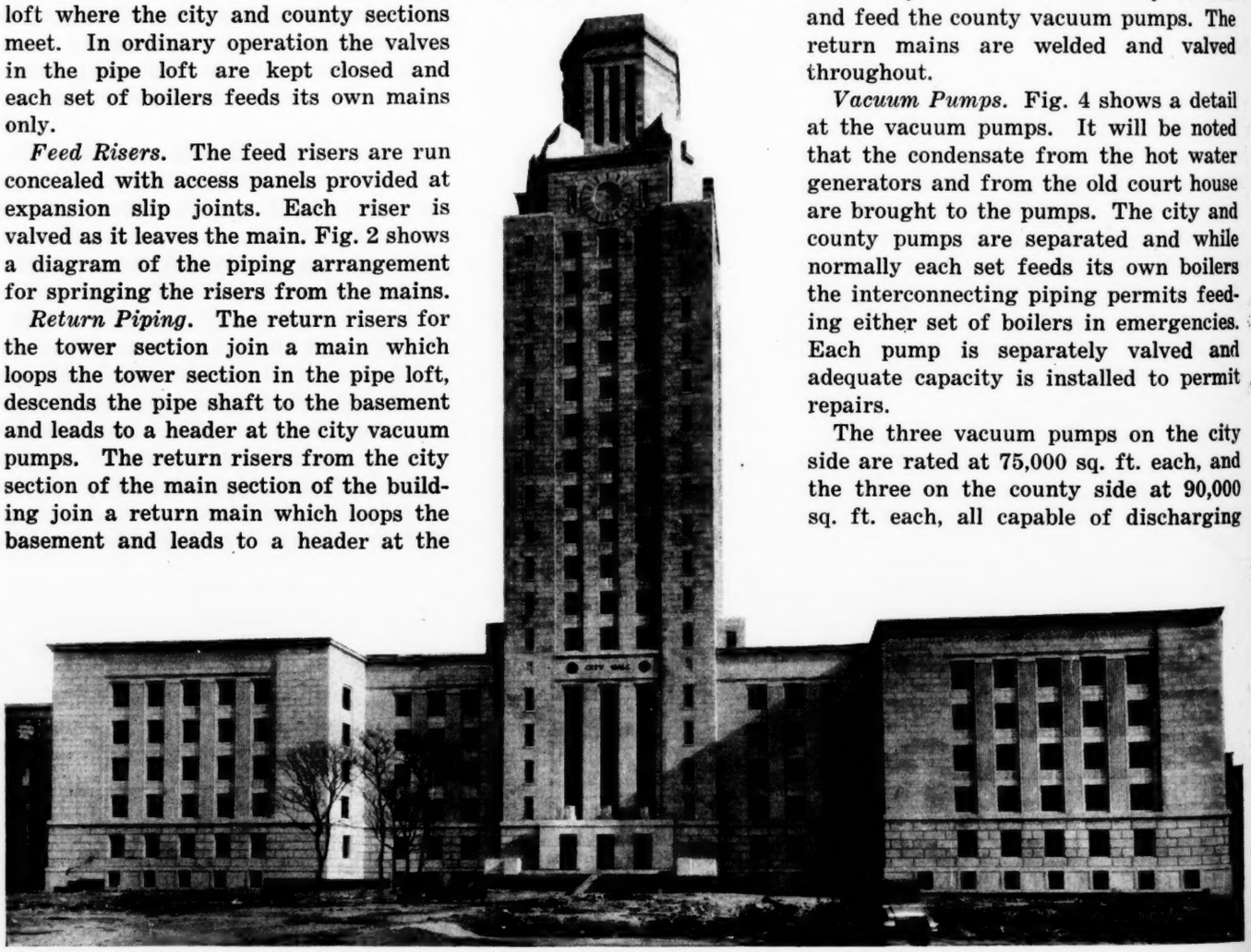
Anchorage is provided at the bottom of the vertical mains and expansion takes place between anchorages. Slip joints provide for vertical expansions. The mains are valved at the boilers and at the points in the pipe loft where the city and county sections meet. In ordinary operation the valves in the pipe loft are kept closed and each set of boilers feeds its own mains only.

Feed Risers. The feed risers are run concealed with access panels provided at expansion slip joints. Each riser is valved as it leaves the main. Fig. 2 shows a diagram of the piping arrangement for springing the risers from the mains.

Return Piping. The return risers for the tower section join a main which loops the tower section in the pipe loft, descends the pipe shaft to the basement and leads to a header at the city vacuum pumps. The return risers from the city section of the main section of the building join a return main which loops the basement and leads to a header at the city vacuum pumps. All the returns from the city section thus return to a common header at the city pumps. The returns from the county section are arranged in the same way as those for the city section and feed the county vacuum pumps. The return mains are welded and valved throughout.

Vacuum Pumps. Fig. 4 shows a detail at the vacuum pumps. It will be noted that the condensate from the hot water generators and from the old court house are brought to the pumps. The city and county pumps are separated and while normally each set feeds its own boilers the interconnecting piping permits feeding either set of boilers in emergencies. Each pump is separately valved and adequate capacity is installed to permit repairs.

The three vacuum pumps on the city side are rated at 75,000 sq. ft. each, and the three on the county side at 90,000 sq. ft. each, all capable of discharging



View in County Pump Room

against a 20 lb. head and so connected and valved that any two pumps may be operated at one time.

Service Hot Water. Service hot water is heated by passing steam through closed exchangers which are thermostatically controlled and are connected as shown in Fig. 3. House pumps circulate this water through storage tanks to the fixtures.

There are five hot water generators, the two on the county side being capable of heating 3000 gal. of water per hr. from 50° to 180° with atmospheric steam. The three on the city side are rated the same as the county generators.

Boiler Plant. Fig. 1 gives a good idea of the boiler arrangement. The city and county boilers are each installed side by side across the firing aisle from each other. Each battery feeds into its own header and the headers are interconnected and valved.

The city battery of two boilers consists of one cross-drum water-tube type steel-plate brick-set boiler rated at 518 hp. and one rated at 355 hp. Both are designed for 175 lb. pressure.

The county battery consists of three boilers each of which is rated at 355 hp., duplicates and similar to the smaller city boiler. This arrangement permits of considerable flexibility in operation, provides reserve capacity for outage, and permits the keeping of a minimum supply of spare parts.

The boilers are all stoker-fired, being equipped with overfeed natural draft stokers.

Provisions have been made for the future burning of fuel oil, if necessary. There are three 6330 gal. fuel oil storage tanks with connecting piping to the inside of the boiler room wall. With the present high settings of the boilers, very little change will be required in case of conversion from coal to oil burning. The change would include removal of stokers and substitution of new boiler fronts and burners and the possible addition of checker brick work for the floors of the combustion chambers. The oil fill and vent lines, with their necessary accessories, have already been provided for.

The boilers are being operated at the present time at 6 lb. pressure. When the contemplated surrounding buildings become realities, steam will be supplied from the court house plant and the boiler pressure raised to meet the new requirements with reducing valves installed in the present court house supply mains.

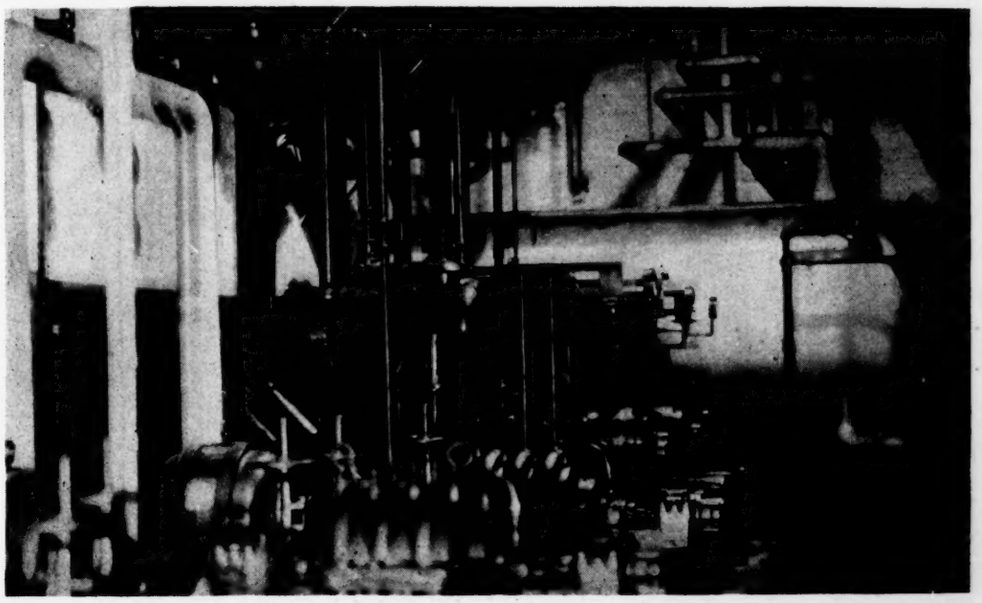
The coal supply at present is dumped in from the sidewalk and carried by screw conveyors to the 200-ton capacity coal storage. Motor-driven trucks equipped with elevator buckets are provided for lifting the coal into the stoker hoppers.

Court Room Ventilation. The seven large court rooms are furnished with outside air through unit ventilators set into the walls and by heated air from coils. Removal of vitiated air within the rooms is also provided for by ceiling grilles connected to ducts exhausting into the pipe loft above. In most cases the ventilating units are located at windows, discharging vertically through the sills.

Eight fans on the fifth floor pipe loft supply air to heating coils located in the court rooms about 10 ft. above the floor, discharging horizontally into the room.

Toilet rooms are ventilated by means of four exhaust fan systems. In the basement and sub-basement the city pump room has both a supply and exhaust fan, and the county pump room has the same. The boiler room has an exhaust fan discharging directly into the space surrounding the boiler plant.

Studio Ventilation. The broadcasting studio is supplied with outside air by a unit heater whose inlet is connected to outside air through the wall of one of the setbacks in the tower. The air is passed through ducts and introduced into the studio rooms just below the ceiling in the side walls. Exhaust outlets are located in the ceiling.



House Pumps, Vacuum Pumps and Hot Water Generator on City Side

Some Impressions of Current Practices with

Public Building Plants

THE first impression gained in either a survey of plants installed in buildings erected with public funds, or from examining plans for such buildings, is the relative simplicity of the heating and ventilating provided. Questionnaires returned and conversations with engineers confirm the impression. This is perhaps the most clean cut of the several outstanding points in connection with the plants installed in such buildings.

Naturally the question arises as to why this is true. As soon as it was evident that the plants really were very modest in their use of available equipment, questions were put to various people asking why the practice is so general. The replies were both interesting and enlightening.

In the first place it developed that in many cases the equipment as actually installed in the completed building is sharply different from the original plans and recommendations. In this feature public buildings are not peculiar, for the same thing happens on others, to be sure. There seems to be a general feeling, though, that public buildings are more sharply subjected to the cutting process than are others.

UNDOUBTEDLY an important cause for this condition lies in the inflexibility of the amount of money available. The money, being under the control of public boards which are often limited by legal enactments and by bond issues made available in fixed amounts and for specific purposes, is often found inadequate when final estimates are obtained and there is no way to increase the amount. The only alternative is to cut and trim to meet it. The feeling that a publicly erected building must be a show place seems to be deeply ingrained both among architects and among public officials. Consequently, they are extremely loath to cut any items which will affect the outward appearance. Usually, therefore, the cutting is done at the expense of the equipment installed, and that for heating and ventilating purposes seems to be especially regarded as legitimate prey.

Another contributing factor mentioned by some is the system in use whereby the contract for construction must perforce be awarded to the lowest bidder. Often this bidder has political connections which permit him to cut corners in spite of specification provisions to such an extent that the completed plant is not in accordance with the recommendations.

A THIRD reason for simplicity of plant lies in a fact which is somewhat surprising. We are all so used to thinking of public officials as persons utterly calloused to corruption that it is unusual to learn that there are those who are not. So careful are some boards that no breath of scandal shall possibly touch any building with which they are concerned that they lean over backward in their attempts to avoid it. It was repeatedly mentioned that boards and officials often refuse point-blank to sanction any elaborate or unusual features in spite of recommendations and assurances from all concerned with the preparation of plans and in spite of having money available. The refusal is based on the fact that they fear that because the method is new or novel or out of line with their own ideas that they may be subjected to criticism or to legal difficulties if they approve its use.

Very often, too, other divisions or other officials are responsible for the operation of the physical plants. Those directing the plans for the original installations are often inclined to think that they have no responsibility for the operating results obtained and pay scant attention to this phase. They feel that if a plant can be made to heat the building reasonably well it is a successful plant. Undoubtedly, very simple plants can be made to do this if operating economy is not a prime consideration.

ANOTHER point mentioned by some is that many public officials simply are not convinced of either the value or necessity of anything more than a positively minimum plant.

In the main, then, the simplicity of plants is often due to causes beyond the control of the engineer. The fact that they are so simple and are so often stripped to the bare necessities represents his failure to control these causes rather than his idea of what the plant ought to be.

THE generic simplicity of the heating and ventilating installations in public buildings must not be taken to mean that this is by any means true of all. Some of

the installations are undoubtedly models of present-day practice in the art. It must be admitted though that the tendency is for these plants to be installed in buildings used for public purposes but erected with funds not obtained by taxation. In such cases boards or officials are often given much more sweeping powers and feel free to accept recommendations. Moreover, the problems encountered in such buildings are often rather highly specialized.

In connection with the preparation of material for this reference number, HEATING AND VENTILATING gathered much information concerning current practice with public buildings. The information, which was obtained from questionnaires and interviews, resulted in our receiving several impressions concerning this work. These impressions are summarized here.

Hospitals are apparently coming to give considerable attention to the possibility that there may be a close relationship between the atmosphere and the most effective treatment of certain diseases. Already this feeling has led to the introduction of oxygen chambers for the treatment of pneumonia, to high pressure atmosphere, and to some isolated installations of apparatus for controlling the atmosphere. While this cannot yet be said to have reached the stage where hospitals in general have adopted the practice of using highly developed and specialized plants, it does show a tendency to at least examine the specialized problem.

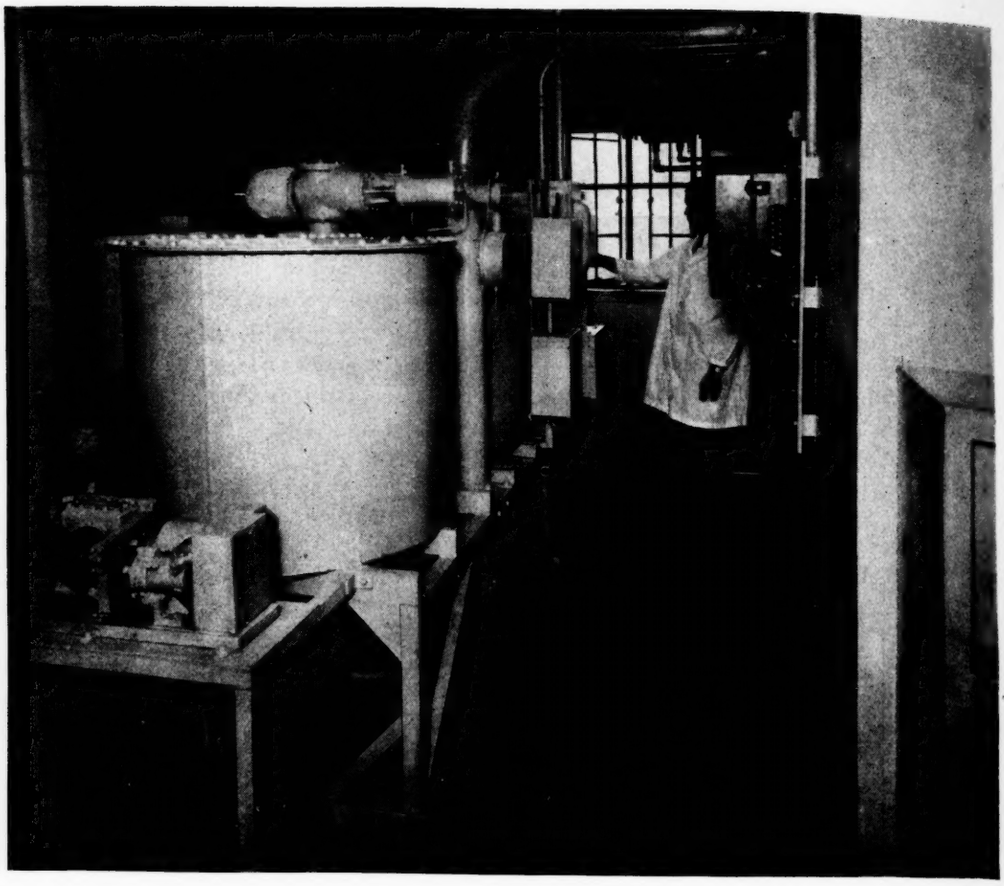
MUSEUMS and art galleries constitute a class of buildings presenting a special problem. Not only is much attention paid to the problem but considerable headway has been made toward a solution. A number of such installations are now in existence using practically all the refinements of plant available. The operating staffs and officers of such buildings are keenly aware of the importance of the problem. Because of having had experience with the loss of valuable articles they have taken active steps to solve the problem. As the director of one of the largest of these museums put it, the managers feel that the preservation of their rare works of art is of more importance than the maintenance of strictly comfortable surroundings for the users of the building. The determination and close maintenance of suitable temperatures and humidities is of very great importance and is somewhat difficult because of the narrow range. Too high temperatures cause cracking of the oil from the surfaces of paintings while tapestries mold when humidities are too high. The director stated that the experience at this museum has caused them to set up 68° and 50% relative humidity as the desirable standard.

INQUIRIES directed to museum and library staffs also brought out their feeling regarding the dust in the air. While the replies varied with the locality and surroundings, the majority indicated that they find the dust problem serious and objectionable and are keen for a satisfactory solution. In the main they do not particularly like to display their pieces in cases but feel obliged to do so largely because of dust entering from windows and doors. Serious efforts are being made to correct the difficulty and ultra-modern plants and methods are used in some cases.

At first glimpse it would seem that practices in public building installations are rather standardized but the great variety of special problems involved and the many means used in solving them give the distinct impression that these buildings still present plenty of room for the application of individual ideas and out-of-the-ordinary methods of attack.

AN impression which seems worthy of mention is the almost total lack of systematic operating methods and records. The reason for this no doubt lies in many cases in the fact that the plants contain few if any operating instruments, probably as a result of the necessity of keeping down first costs. Operation seems to be distinctly a secondary matter in the plants of public buildings. Where, however, special requirements exist the operation is carefully watched. As if to prove the rule some exceptional plants carry very complete sets of operating instruments and maintain very complete operating records. Just why operation seems, in general, to be so overlooked in such plants is a matter of conjecture. It is suggested that there are several factors contributing to it. Among these, in addition to a lack of operating instruments, is the practice of separating the operation from the planning and with but little coordination between the two functions, the rather rapid rotation in office so often found, the absence of any technical advice on operating questions, and the fact that there is no widely accepted common denominator of operation.

THE outstanding impressions gained are: (1) The heating and ventilating is accomplished by almost severely simple plants in the great majority of publicly erected buildings; (2) Individual buildings present sharply specialized problems which are being attacked vigorously and which are often solved in ingenious fashion. The designs and methods used with such buildings are by no means standardized; (3) on the whole the plants are not operated with a high degree of either care or skill.



Silica Gel Unit with Automatic Control in Foreground. In the Background is Shown the Silencer, Filter and Fan Switches. The Gas Analyzer is Mounted on the Wall

Air Conditioning Special Hospital Rooms

by **G. T. Shoosmith***

UNTIL recent years the oxygen chamber has remained outside the realm of conventional hospital equipment, since oxygen can be administered adequately by simpler means. However, an atmosphere of controlled temperature and humidity, in addition to the administration of oxygen, has many probable benefits to persons suffering from respiratory troubles, and this was foreseen long before adequate air conditioning could be attained.

In 1927 the Harlem Hospital, New York, through Dr. Jesse G. M. Bullowa, installed an oxygen chamber using silica-gel air conditioning, providing independent control over the temperature, humidity and carbon dioxide content of the air circulated. This installation was the first of its kind and aroused considerable interest among members of the medical profession. The more recent installation of three such chambers, intended primarily for the treatment of pneumonia cases, at the University of Maryland Hospital, Baltimore, represents an important step forward in oxygen therapy. In addition to pneumonia cases, premature infants have been treated.

**Silica Gel Corporation, Baltimore.*

PROPERTIES OF SILICA-GEL

Silica-gel is a hard, semi-transparent material, resembling quartz. Chemically it is pure silicon dioxide. In structure it resembles a sponge, but its pores are so small that not even the most powerful microscope can reveal them to the human eye. Due to the capillary effect of these minute pores, the gel has an enormous absorptive appetite, being capable of holding as much as 40% of its own weight of water vapor without external wetness or distortion. If a stream of air is passed through the gel, it will absorb moisture, odors, and even gases. Upon applying heat, the absorbed matter is readily driven out of the gel. This process of absorption and desorption can be repeated indefinitely without in any way reducing the efficiency of the gel, since the action is purely physical.

The advantage of silica-gel, from an air conditioning standpoint, lies in the fact that it is possible to control the humidity of the air independently of its temperature, and that a much lower humidity can be attained, if desired, than is practical by refrigeration. By means of silica-gel, any desired conditions can be maintained with equipment which does not require skilled operators for its control.

CONSTRUCTION

In the Maryland installation there are three adjoining separate chambers, constructed of a sheet metal wall with an insulating air space separating it from the outer covering of sound and heat-proof paneling. The windows, of extra heavy glass, are cemented in gas-tight sockets. The doors are of metal construction, heavily insulated, and equipped with special four point catches which automatically force the door against its sealing strip when it is closed.

Each chamber has one wide door, through which the patient is admitted, and a lock through which the nurses enter without causing leakage of oxygen. There are also provided small locks through which food, etc., is passed. Other equipment of the chambers includes a gas-tight speaking tube, alarm signal, and water spray for fire protection. Indirect lighting is obtained through ceiling windows, over which are mounted powerful lights. An adjustable blind enables the attendant to vary the intensity of the lighting.

Inside dimensions of the chambers are 9 ft. × 7 ft. 8 in. × 7 ft. 6 in. high.

TEMPERATURE CONTROL AND CIRCULATION SYSTEM

The circulation system is so arranged that each chamber can be maintained at whatever different temperatures are desired. In addition to this, one chamber, which is used for heat therapy, can be disconnected from the main system and operated separately.

Temperatures from 50° to 180° F. can be maintained in any of the chambers, though the higher temperatures are only desired in the heat therapy room which is insulated with an extra layer of mineral wool.

The main circulating fan delivers a maximum of 600 c.f.m., equivalent to one air change every two and one-half minutes in the entire system. A separate fan for the heat therapy chamber delivers 200 c.f.m. These fans have variable speed motors, allowing a wide range in the volumes circulated. Each chamber is provided with valves which permit shutting it off completely when not in use.

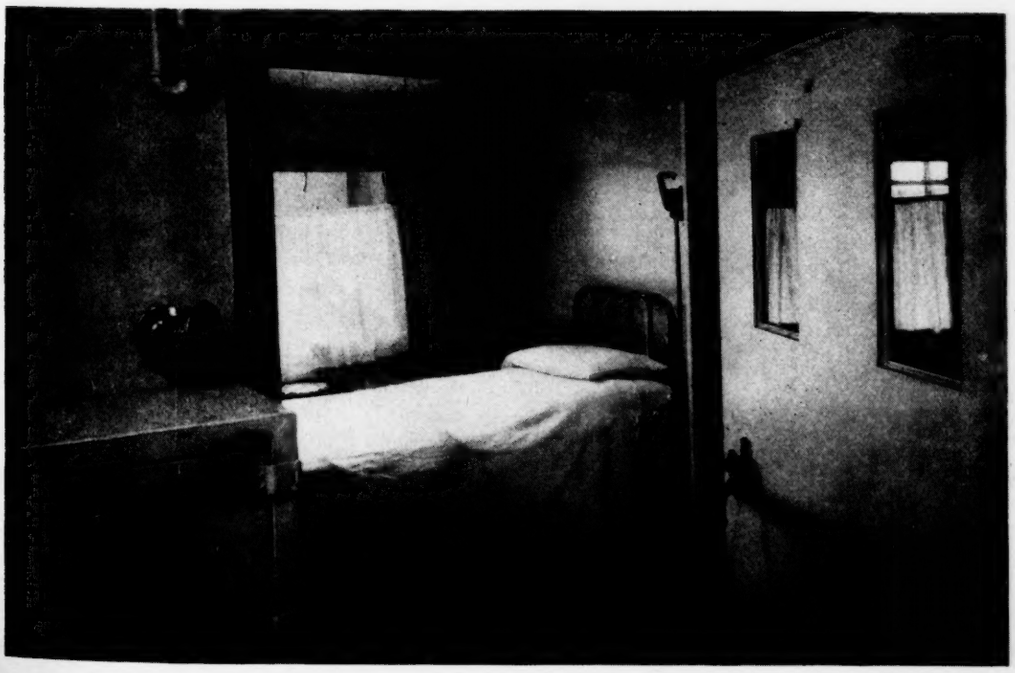
Air leaves the chamber through a grille situated near the ceiling and passes back through a silencer to the circulating fan. A portion of this air is by-passed through the silica-gel which removes the water vapor and carbon dioxide given off by the occupants. From the circulating fan the air passes through a filter to the supply header. From this header ducts run to the individual chambers. Each duct contains a radiator type heater-cooler unit. Water, steam, and, in hot summer weather, brine, are used for the temperature control. The drawing shows the arrangement of the apparatus diagrammatically, and indicates the amounts of air circulated during one particular day.

SILICA-GEL ABSORBERS

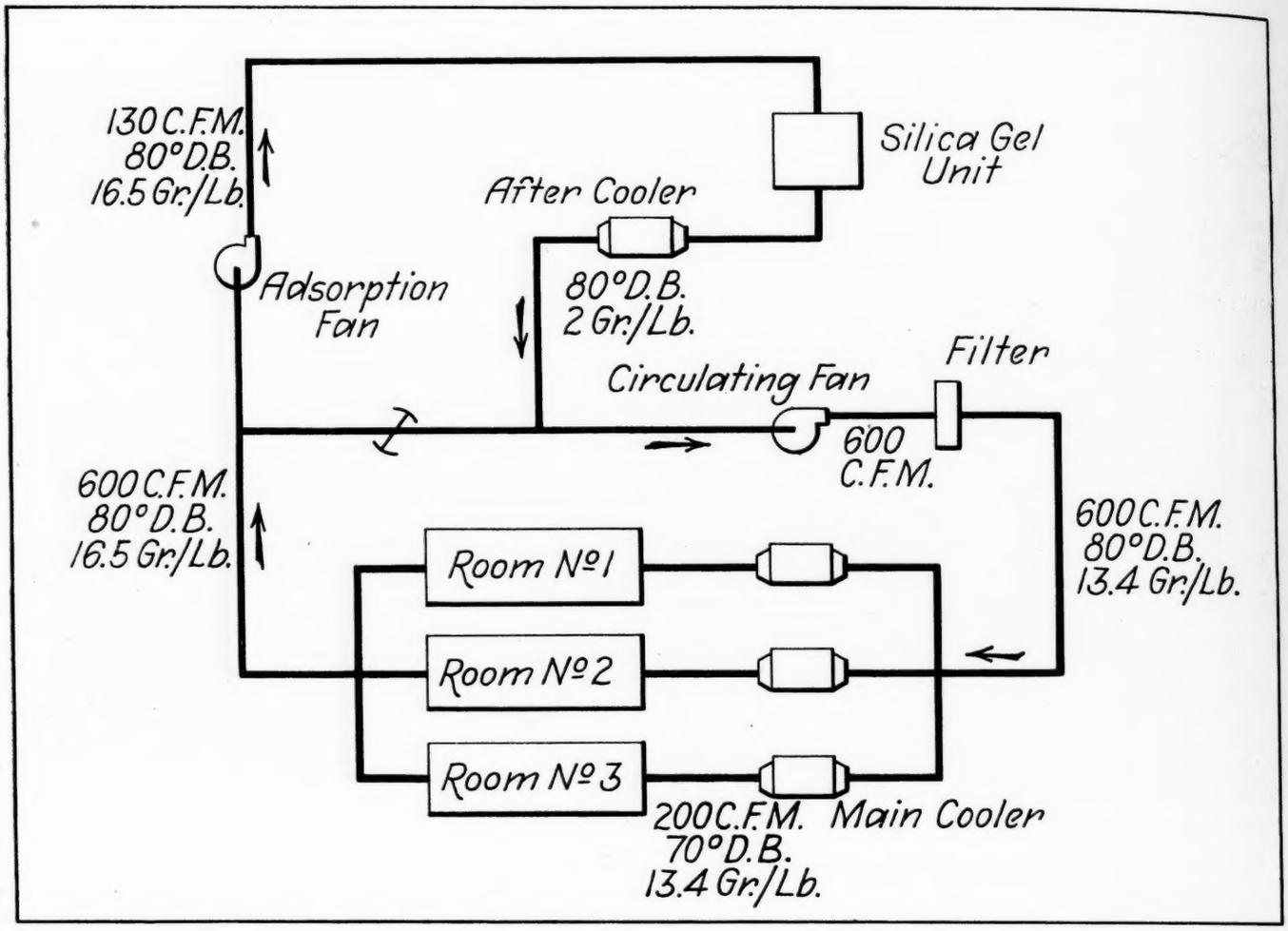
The silica-gel unit consists of two cylindrical absorbers each containing a bed of granular gel. While one of these absorbers is treating the air, the other is being revivified. The entire action of the unit, including the revivifying or "activation" of the gel, is automatic, and valves controlling the alternation of the absorbers being operated pneumatically through an electric clock. A valve controls the volume of air passing through the gel, thereby enabling any desired humidity to be maintained in the chambers.

DECARBONATOR

A "by-pass" from the main circulating duct leads to a decarbonator. This consists of a series of shallow perforated trays which are filled with flake sodium hydroxide. Valves on either side of the decarbonator enable it to be cut into the system whenever it is required. In the ordinary operation of the chambers the carbon dioxide generated by the occupants is removed by the silica-gel. If it is necessary to maintain a carbon dioxide concentration in the chambers above normal, this gas can be introduced through pipes provided for the purpose. In order to reduce the carbon dioxide con-



Interior of one of the Air Conditioned Chambers in University of Maryland Hospital



Flow Sheet Showing Conditions Maintained During a Test on One Particular Day (D.B.—Dry Bulb Temperature)

centration to normal again it is necessary to employ the decarbonator. Since the air coming in contact with the chemical is comparatively dry, the full useful capacity of the charge is obtained.

One person generates approximately 1.6 lb. of carbon dioxide per day, and without the silica-gel it would be necessary to supply about 15 lb. of sodium hydroxide per day to remove the carbon dioxide generated by six occupants.

ELIMINATION OF ODORS AND NOISE

In addition to removing carbon dioxide, the gel effectively removes all odors. By passing the entire flow through the gel, which can be done by closing a damper in the main duct, all odors can be removed from the air in the space of one minute. This effectively prevents the communication of odors from one chamber to another.

In order to eliminate noise, the fans are mounted on special bases, and all duct and grille velocities kept below those usually employed in ventilating systems.

OXYGEN SUPPLY

Oxygen supply is taken from a ten tank manifold in the basement, and delivered to the chambers at 150 lb. per in. pressure. The chamber manifold is equipped with an expansion valve and flow gauge, and the supply lines to the individual chambers are equipped with orifice manometer flow gauges, enabling the supply to each chamber to be regulated independently.

CONTROL AND RECORDING INSTRUMENTS

A six point Englehard gas analyzer gives a continuous record of the carbon dioxide and oxygen concentration in each chamber. For this purpose continuous samples are taken from each room by small pumps.

The heat therapy chamber is provided with a porous sleeve hygro-thermometer, the other two chambers with recording hygro-thermographs. These instruments are placed in the upper corners of the main windows of each chamber, enabling them to be read from the outside.

Controls are so arranged that the nurses are able to maintain the desired conditions of humidity, temperature and oxygen concentration without assistance.

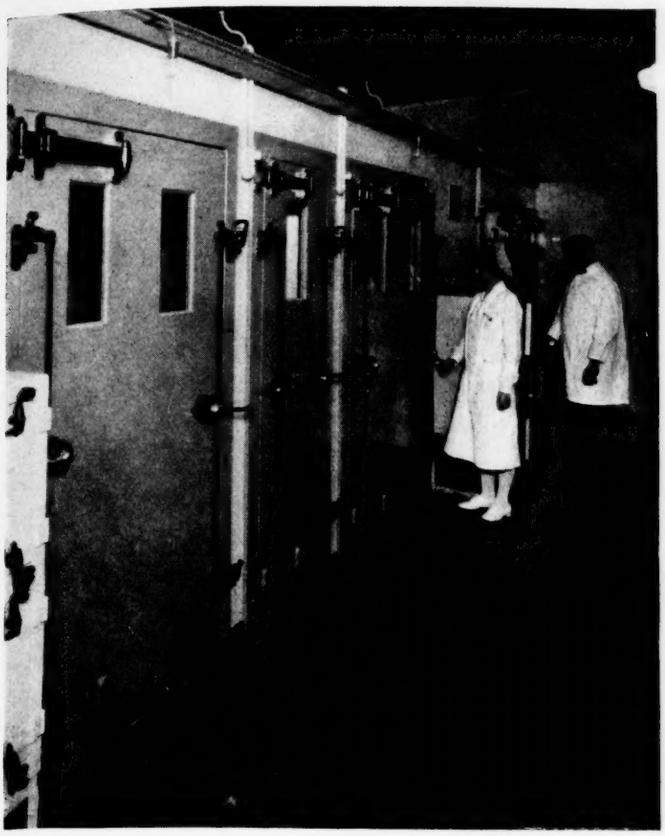
Gas analyzers are checked daily by a member of the hospital staff, a special Haldane apparatus being used.

MAINTENANCE

Maintenance of the equipment requires only weekly or monthly lubrication of the fans and motors, and the periodical refilling of the chemical dryers on the gas analyzers.

CIRCULATION DATA

The nominal requirement of the air conditioning equipment is to maintain 15% relative humidity at 70° F. in all three chambers, under maximum outside



Entrance into Air Conditioned Chambers

conditions of 95° F. and with a total of six persons in the chambers.

An average coefficient of heat transfer of 0.4 was taken for the walls and ceiling which, with a circulation of 600 c.f.m. gives a temperature rise of 10° F. and a moisture pick-up of 3.1 grains per lb. of air through the areas. However, in order to enable the rooms to be brought quickly to any desired conditions, the equipment was designed with a large safety factor.

Under actual tests, all three chambers have been brought from 60% relative humidity at 75° to 10% relative humidity at 60°, within one hour, with six occupants. A humidity of 10% can be maintained indefinitely, and humidities as low as 3% have been obtained in a short space of time by shutting off two of the chambers temporarily.

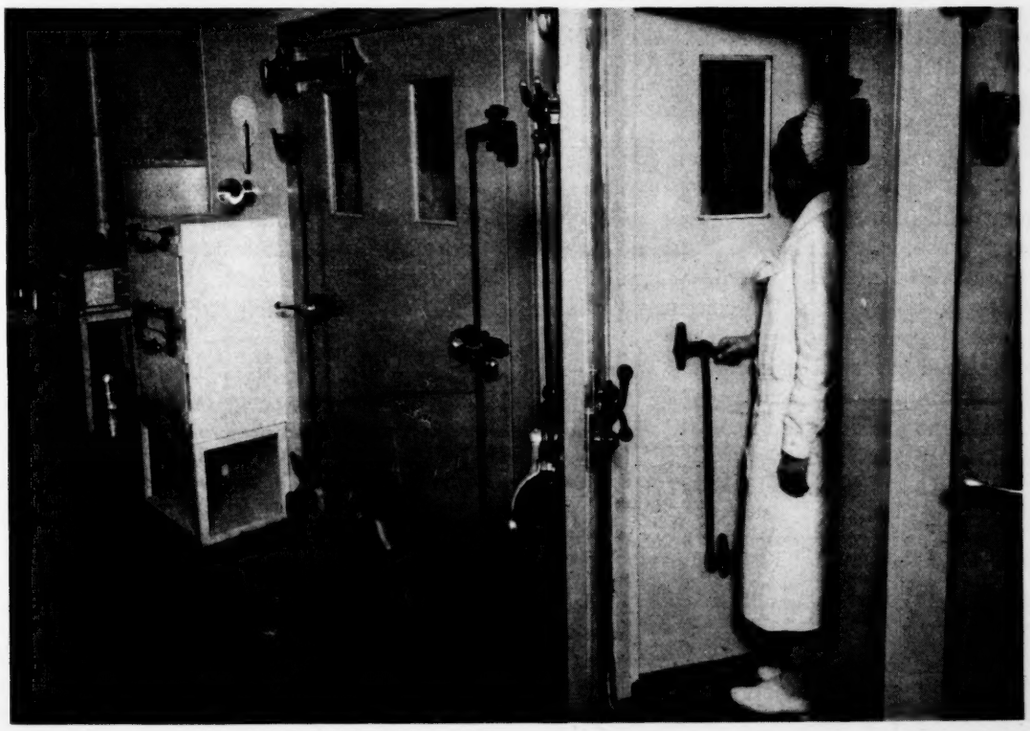
The heat therapy chamber can be brought from a room temperature of 70° to 150° in well under an hour. The special circulation system for this room is equipped with a fresh air supply and exhaust, and a wide range of humidity can be obtained by varying the amount of fresh air introduced.

For cooling purposes tap water is sufficient for the major portion of the year. During the warmer months, when chamber temperatures of 70° or less are required, it is necessary to use brine. For example, under maximum outside conditions of 95° to 100°, one-half ton of refrigeration would be required to keep all three chambers at 70°.

The highest duct velocity used is 1000 ft. per min. and the maximum grille velocity is 400 ft. per min.

The grilles are located at diametrically opposite corners of the same wall, the inlet being at the floor. There is no sign of a draft and absolutely no noise when the system is in operation.

The rooms were primarily designed for the treatment of pneumonia, in which the breathing of cool dry air, by increasing the evaporative loss from, and purging of, the lungs, provides great relief. The physicians in charge of the installation are not as yet able to report definitely as to the results obtainable with other diseases. The production of an artificial fever to replace injection methods, the treatment of shock, heat stroke, etc., have not yet been sufficiently investigated for data as to the desired conditions to be maintained, and the efficacy of the treatment, to be published.



Arrangement of Doors into Air-Conditioned Chambers

Calculating the Proper Thickness of Insulation

by **Edgar C. Rack***

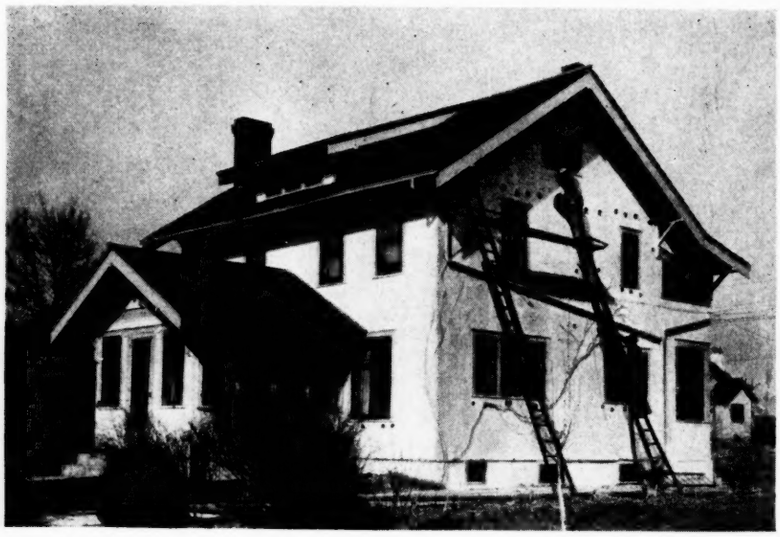


Fig. 1. Applying Insulation Between the Studding of an Existing Stucco House

IN the analysis of the subject of selecting the proper thickness of insulation for buildings heated by coal-fired systems, recently presented on these pages[1], the author has made certain assumptions and analyses which seem, to the writer, to be open to question.

Formula A of the article referred to[2] originally appeared in an architectural publication[3]. It should be noted, however, that in the first presentation of this formula the author utilized the constant 4.2 in place of 3.23 as adopted in the latter contribution. It is explained that this constant is introduced in order to simplify the formula, and its use assumes as fixed factors for all coal-fired heating systems: (a) the calorific value of coal; (b) the over-all efficiency of the heating system; and (c) the total annual period of operation of the system. Use of the constant 3.23 assumes as a fixed value for (a), 13,000 B.t.u. per lb.; for (b), 60%; and for (c), 5,040 hr. per year. While no explanation has been offered, it is believed that 4.2 was utilized for use as a constant in the former presentation of this formula by fixing (a) at 12,000 B.t.u. per lb.; (b) at 50%; and (c) at 5,040 hr. per year.

The author gives no reason for this revision of his opinion as to what might be assumed as constant average values for the above factors, neither does he explain why these values may be assumed as generally representative of average universal conditions. It is of interest to note that if the constant 4.2 is utilized in Formula A for arriving at the so-termed correct thickness of insulation for use under the conditions given in the typical example analyzed by the author, the thickness for use will be 1.6 in. It is seen that this thickness is 55% greater than that determined for use when the constant 3.23 is utilized. If any of the commercially procurable one-half inch thick insulating boards are considered for use, three layers would be required in place of two, which will in turn increase the installed cost (an assumed figure) of the insulation by 50%.

From this example it seems that the author has been rather liberal in assuming as constant those factors which necessarily vary and which materially influence results. In the writer's opinion these assumptions cannot be justified, and should not be recommended for adoption by the engineering profession. It is believed that the engineer should give consideration to such an analysis as has been presented by the author. However, it cannot be conceded that the engineer should not also analyze his own problems, make his own estimate of the factors involved and substitute his own findings and conclusions pertaining to such widely varying factors as the calorific value of fuel, over-all efficiency of the heating plant, etc.

A later article[4] in the series referred to contains additional formulae for use when oil rather than coal is utilized, and future articles are contemplated covering gas and electricity. It is felt that such variations of one basic formula can be of no beneficial service to the profession. Presentation of an original basic formula, in which substitution can be made of all variable factors, will find its proper application in the art. It goes without saying that any formula may be presented in a number of conceivable forms with variations applicable for particular localities, diverse classes of construction, individual types of insulation, etc. However, the engineer is well qualified to derive any

In the first two articles of a series by Paul D. Close on "Economics of Thermal Building Insulation," which appeared in the August and October, 1930, issues of* HEATING AND VENTILATING, *Mr. Close presented an elaborate analysis of the subject. The author showed the derivation of a formula for determining the correct thickness of insulation for use under given conditions with coal-fired heating systems, and has also presented a graphical analysis of this formula in order to show the deductions possible by varying factors which enter into consideration in determining insulation thickness. Certain steps in the analysis and assumptions made by Mr. Close are here discussed by Mr. Rack.

*Staff Manager, Engineering Department, Johns-Manville, New York, N. Y.

[1] *"Economics of Thermal Building Insulation," by Paul D. Close,* HEATING AND VENTILATING, *August and October,* 1930.

[2] HEATING AND VENTILATING, *August,* 1930, *page* 71.

[3] *American Architect, March,* 1930.

[4] HEATING AND VENTILATING, *March,* 1931, *page* 65.

particular variation to meet his individual usage. The engineer must analyze his own problems and do his own work; he cannot, for convenience or simplicity, accept approximate methods and expect to obtain other than approximate results.

Determination of the correct thickness of insulation to use for a given set of conditions has always been of interest to both the architect and the engineer. The economic, or optimum thickness, which is the desired result, is that thickness which will give the maximum net monetary saving when subjected to the conditions under which it will be used.

From a study of the author's analytical derivation it is apparent that Formula A will give that thickness of insulation for which the total annual cost per square foot of insulated wall surface is equal to the cost of heat loss per square foot of wall surface if no insulation is used. The thickness so arrived at is based on the over-all return on the investment for insulation as being high (20% return recommended). Formula B is later introduced[5] "merely to show that the selection of the value of r (return on the insulation investment) of 20% for Formula A is not arbitrary, because for this over-all value, the return for the final increment is usually about 10%, which, as previously stated, seems to be the logical limit." Mr. Close further recommends Formula A for the determination of the proper thickness of insulation "because Formula A is more simple than Formula B." If the author had presented Formula B in its simplest form it would be readily apparent by comparison of Formula A with Formula B, that the latter does not contain any more factors than the former does, and involves only one more step in its solution; that of extracting the square root of the first term.

There have been many contributions to the literature on the subject of the economics of thermal insulation; however, most methods presented to date have been graphical. All authorities agree that the most economical, or optimum thickness of insulation for use in any case is that thickness which will result in a maximum net monetary saving. The optimum thickness is determined *exactly* by Formula B which determines that thickness of insulation for which the final increment will pay the required minimum return on the additional cost of that increment. This method for determining the most economical thickness of insulation, together with the derivation of a formula, which is the equivalent of Formula B, was first presented by the late L. B. McMillan.[6]

Mr. Close states: "It will be found from an analysis of a large number of problems that the thickness determined from Formula A based on an over-all return of 20%, when substituted in Formula B will give an instantaneous return (on the cost of the last increment) of between 9% and 10% when solving for I_r" (instantaneous return). If the author had carried out his analysis with a comparison of Formula A and Formula B as fully as he has elaborated on his analysis of Formula A only, it would be seen that this statement is not even approximately correct. For purposes of comparison the

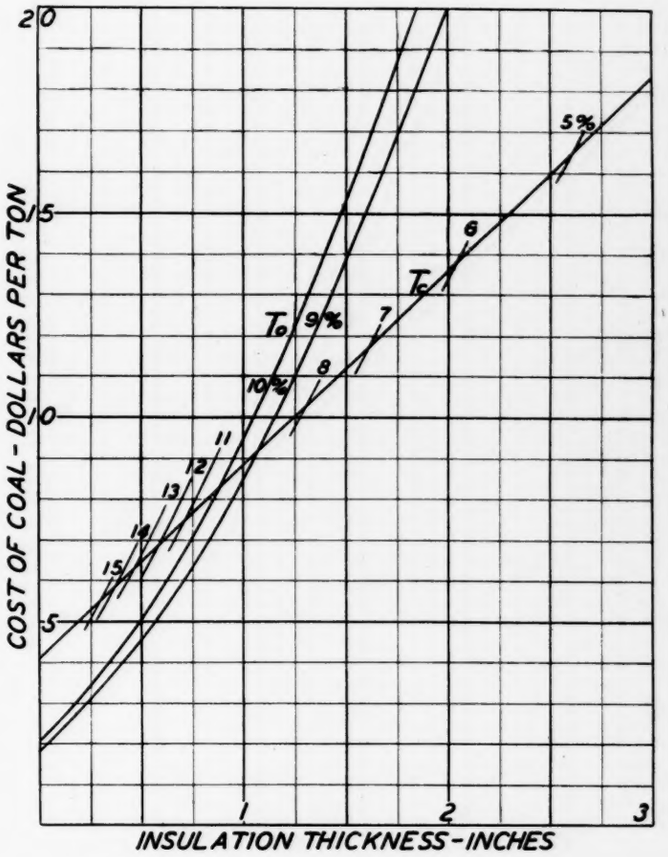


Fig. 2. Variation in Thickness of Insulation with Cost of Coal

writer shows herewith only two of the six curves used by the author to illustrate the deductions made from the use of Formula A. These curves are based on what the author classes as a typical problem, and while the writer does not agree with Mr. Close, as to the correct solution of this problem, it is agreed that all assumed factors may be classed as representative of average conditions frequently encountered in heat transfer calculations.

Fig. 2 shows the variation in thickness of insulation with the cost of coal. Curve T_c is reproduced from the author's article and denotes the required thickness of insulation as determined by Formula A. Curves T_o (9% and 10%) give the optimum thicknesses as determined by Formula B when 9% and 10%, respectively, are taken as the required return on the last increment of thickness. It is seen, as the author has stated, that the results obtained by the two formulae fall within the specified limits when the cost of coal is $9.00 per ton. However, if the cost of coal is $15.00 per ton, the use of Formula A would call for 2.3 in. of insulation while the optimum thickness required would be 1.48 in. and 1.61 in. when it is desired to receive a return of 10% and 9%, respectively, on the final increment of thickness.

When using Formula A, and for the specific example considered by the author, the relation between the cost of coal and the insulation thickness is:

$$T = 0.211C - 0.87$$

or,

$$C = \frac{T + 0.87}{0.211} \qquad (1)$$

[5] Heating and Ventilating, *October*, 1930.

[6] *Transactions A.S.M.E., Volume* 48, 1926, *page* 1300.

When the optimum thickness Formula B is used for the same example, this relation is found to be:

$$T = \sqrt{\frac{3.665C}{I_r}} - 0.87$$

or

$$C = \frac{I_r\,(T + 0.87)^2}{3.665} \qquad (2)$$

where

T = Insulation thickness—inches.

C = Coal cost—dollars per ton.

I_r = Instantaneous return (return on final increment of thickness)—percent.

then

$$\frac{T + 0.87}{0.211} = \frac{I_r\,(T + 0.87)^2}{3.665}$$

or

$$I_r = \frac{17.37}{T + 0.87} \qquad (3)$$

By the use of this equation (3) the return on the investment for the final increment of thickness can be found for any thickness which may be determined by the use of Formula A, when an over-all return of 20% on the investment is used as a basis of determination, and when the cost of coal is varied in the example considered. The intersection of T_o curves for various returns on the investment for the last increment of thickness ranging from 5% to 15% are shown on curve T_c. As stated, curve T_c is based on obtaining a 20% return on the over-all investment. The author has stated that an analysis of a large number of problems will show thickness determinations made with the use of Formula A, based on an over-all return of 20%, and when substituted in Formula B, will give an instantaneous return of between 9% and 10% when solving for I_r. The analysis made, and which is graphically shown by Fig. 2, does not bear out this statement. The instantaneous return, or the return on the final increment of thickness, is between 9% and 10% only for that thickness of insulation determined with Formula A when coal costs vary from approximately $8.25 to $9.25 per ton.

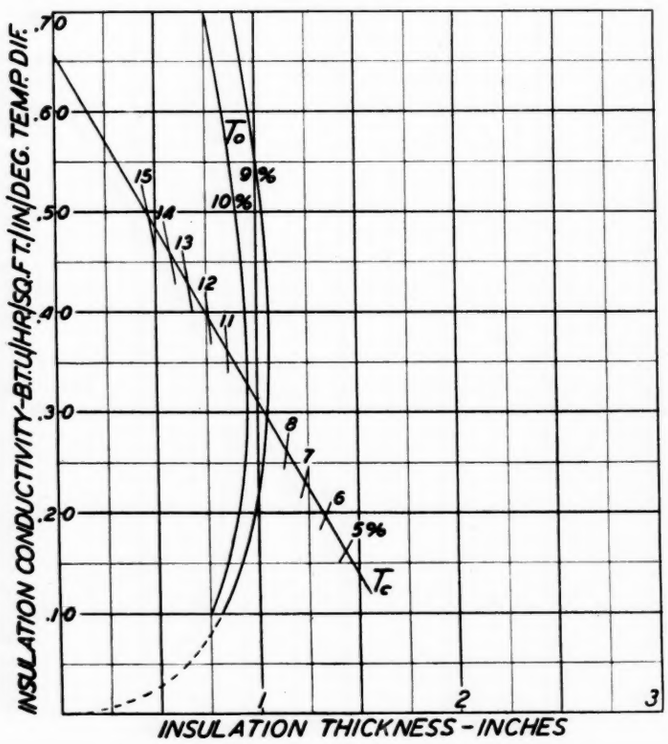


Fig. 3. Relation Between Conductivity and Required Thickness of Insulation

It is seen that with a coal cost of $15.00 per ton the use of Formula A requires 2.3 in. of insulation in order to obtain an over-all return of 20% on the investment. The return obtained on the final increment of thickness when using 2.3 in. of insulation will be 5.5%. The author has stated: "It seems logical, however, that the limiting value of the thickness should be set at an instantaneous return higher than 6% as this is the standard money rate in many localities and some allowance should be made for depreciation of insulation, repairs, insurance, etc." The writer is in full accord with this statement. The optimum thickness as determined by Formula B, and when a return between 9% and 10% is desired on the cost of the final increment of thickness, will be between 1.61 in. and 1.48 in. as the upper and lower limits of the insulation thickness. Fig. 2 also shows that for a coal cost of $5.00 per ton, curve T_c (Formula A) specifies a thickness of 0.18 in. of insulation, whereas the optimum thickness formula (curve T_c, 10%) determines a thickness of 0.48 in. for the conditions assumed. While the over-all return on the investment for 0.18 in. will be 20%, the return on the additional investment for the final increment will be 18.3%, or 83% more than the author has specified as being the logical limit. With a coal cost of $5.00 per ton, and using Formula A as a method of thickness determination, it is unlikely that the owner would apply any insulation, due to the probable inability of securing (at the price) a commercial thickness satisfactorily near to 0.18 in. thick. When the optimum thickness is determined by Formula B, even at this low cost of fuel, a commercially procurable thickness of material, namely, ½ in. could be applied.

Curve T_c shown on Fig. 2 is the same as the author's Fig. 3[7], and denotes the relation between conductivity and required thickness of insulation determined with Formula A for the assumed example. Fig. 3 also gives curves T_o (9% and 10%) which denote the relation between the optimum insulation thickness and the conductivity of the insulation as determined for the same conditions by the use of Formula B, and when the logical limit of the return on the investment for the final increment of thickness is set at 9% and 10%, respectively.

The author further shows in the article[7] that for Formula A, and with the conditions assumed for the example under consideration:

[7] HEATING AND VENTILATING, *August*, 1930, *page* 72.

$$T = 1.90 - \frac{k}{0.345}$$

or

$$k = \frac{1.90 - T}{2.895} \qquad (4)$$

With the optimum thickness Formula B, and for the same assumed conditions this relation is

$$T = \sqrt{\frac{109.94k}{I_r}} - 2.895k$$

or

$$k = 0.0328\ I_r \qquad (5)$$

where

k = Conductivity of insulation—B.t.u. per hour per square foot per inch thickness per degree temperature difference.

then

$$\frac{1.90 - T}{2.895} = 0.0328\ I_r$$

or

$$I_r = \frac{1.90 - T}{0.0951} \qquad (6)$$

Equation (6) can be used to determine what the return on the investment for the final increment of thickness will be for values of thickness obtained by Formula A when the conductivity of insulation is varied. It is seen from Fig. 3 (curves T_o) that the optimum thickness, for use under the conditions specified and when a return of between 9% and 10% is desired on the final thickness, will be approximately 1 in. for all conductivity values between 0.20 as the lower, and 0.55 as the upper limit. For an over-all return of 20%, and in order to obtain between 9% and 10% on the final increment of thickness, Formula A (curve T_c) would specify 1 in. of insulation having a conductivity limited to the narrow range between 0.295 and 0.325 inclusive.

Fig. 3 also denotes the intersection of T_o curves on curve T_c for returns on the final increment of thickness varying from 5% to 15% inclusive. By reference to curve T_c (Fig. 2) it is seen that Mr. Close would endorse the use of 0.31 in. of insulation having a conductivity of 0.55 in order to be able to obtain an over-all return of 20% on the investment. The application of this thickness will result in a return on the last increment of thickness in excess of 16.75%, or a return on the last increment 67% higher than the logical limit of 10% the author endorses, and which he states will be very nearly approximated by the use of Formula A for determinations of the so-termed correct thickness.

It is further seen that the optimum thickness (curves T_o) will be a maximum at a definite value of conductivity. For conductivity values above or below this maximum point less insulation is required, the thickness approaching zero more rapidly for lower values of conductivity. This is what might be expected and is in strict accord with the principles of engineering economics. If it were possible to secure an insulation having a conductivity as low as 0.15 Formula A (curve T_c)

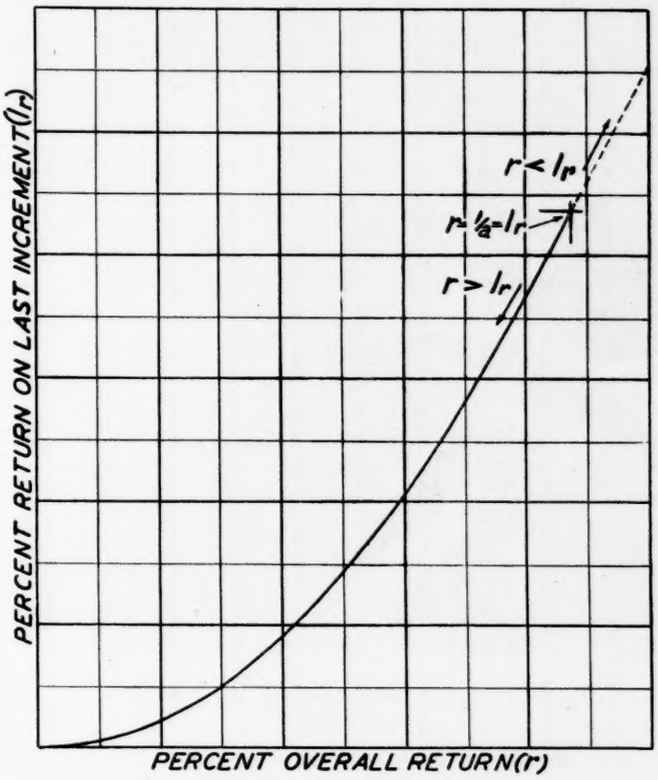


Fig. 4. Relation Between Return on Final Increment and Over-all Return

would, for the particular example under consideration, call for 1.46 in. of insulation in order to obtain a 20% over-all return on the investment. By the use of equation 6 it is seen that the return on the investment for the final increment will, for the conditions assumed, be less than 5%. The optimum thickness (curve T_o) for use in order to secure a minimum return of 10% on the last increment would be 0.85 in.

As heretofore stated, it is to be regretted that the author did not elaborate on Formula B in an analytical comparison with Formula A. The writer does not feel it necessary to make any further comparisons between the two formulae than has been made above. However, comparison of the various deductions which can be made from these two formulae will show that the optimum thickness (Formula B) is not in approximate accord with thicknesses determined by Formula A, except over a narrow range.

Briefly stated, in deriving Formula A, the equation of the curve representing the annual cost per square foot of applied insulation, is placed equal to the equation representing the curve for the annual saving resulting due to the use of insulation, and then solving for insulation thickness. The point so determined is the thickness at which the two curves intersect, or the point at which the annual saving is zero.

The method of arriving at the formula for determining the optimum thickness is to determine that point representing the thickness at which the equation for the curve representing the total annual cost (annual cost of applied insulation plus the annual cost of heat loss) is a minimum. At this point the saving will be a maximum.

An important point brought out in the author's in-

Fig. 5. Blowing Insulation into the Roof of an Existing Building

troductory remarks[9] is that it is not good engineering or business to allow the cost of the last increment of insulation to eat up the handsome profits accruing from the first increments. Each increment of insulation should justify itself or it should not be bought. It might be inferred from other later remarks[10] that a 20% over-all return will give a return on the cost of the final increment between 9% and 10%. As brought out in this analysis, no such simple relation exists between Formulae A and B. It is to be regretted that Mr. Close analyzed an example only at that point where this relation is approximately as he has stated. The relation between the two formulae can be readily seen; inspection shows that the graph of Formula A is a straight line, while that for Formula B is a curve. The relation between the over-all return and the return on the final increment of thickness is in the general form of $y = ax^n$.

If it is desired to determine the over-all return to be obtained under any given conditions, and when an acceptable minimum return on the final increment is considered for use as a basis of insulation thickness determination, the following general formula may be used:

$$r = \sqrt{\frac{I_r}{a}} \qquad (7)$$

where

I_r = Return on final increment of thickness—percent.

r = Over-all return on insulation—percent.

and

$$a = \frac{0.20k\ z\ C_c\ E_c}{N\ c\ (t - t_a)\ U^2}$$

in which

k = Conductivity of insulation—B.t.u. per hour per square foot per inch thickness per degree temperature difference.

z = Installed cost of insulation—cents per square foot per inch thickness.

C_c = Calorific value of fuel—B.t.u. per pound.

E_c = Over-all efficiency of heating system—percent.

N = Annual operation period of heating system—hours.

c = Fuel cost—dollars per ton.

t = Average inside air temperature—degrees F.

t_a = Average outside air temperature during heating season—degrees F.

U = Coefficient of transmission of uninsulated wall (or roof)—B.t.u. per hour per square foot per degree temperature difference.

Fig. 4 graphically shows the relation between the return on the final increment and the over-all return. As the relation between these two returns is in the form of $y = ax^n$, it can be shown that when $r = 1/a$, I_r will also be equal to r. The physical explanation under such conditions is, if the desired return on the last increment is set so high that it will be equal to the over-all return, the limit of economic efficiency is reached. The use of insulation cannot be shown to pay for itself if the return on the final increment is set at a point where it is equal to or higher than the over-all return.

In conclusion, it must be emphasized that in fixing an over-all return on the insulation investment, lower returns may result on the latter increments of thickness than may be economically justified. The proper method for determining the correct thickness of insulation is that which requires the return on the last increment of thickness to be the minimum return acceptable. This is only given by the use of the optimum thickness formula in which proper substitution is made of all variable factors.

Fig. 6. Insulating an Existing Wood Sheathed House with a Minimum of Preparation and Rebuilding

[9] HEATING AND VENTILATING, *August*, 1930, *page* 70.
[10] HEATING AND VENTILATING, *October*, 1930, *page* 76.

State Laws on the Heating and Ventilating of Institutions

WHILE state laws relating to the heating and ventilating of schools and industrial buildings are in force in the majority of well-populated states, there are but few relating to institutional buildings. There are, however, a few sketchy laws relating to the heating of prisons, but these, for the most part, require only that the building be "properly" heated.

Abstracts of the state laws for public buildings which are in force follow:

MASSACHUSETTS

According to Regulations Relative to the Inspection of Buildings, subject to the provisions of chapter 143, General Laws of the Commonwealth of Massachusetts:

For theatres, public and special halls, the auditorium shall have such means as to insure the removal near the floor levels, through ventiducts with approved regulating dampers, of at least 2½ cu. ft. of air per min. for each foot in area of the auditorium and gallery floors, and to supply pure air equal in amount at such height from the floor as to insure proper circulation, with means for the proper heating of such air when necessary, with approved methods for regulating the temperature, and sufficient means for heating to maintain a temperature throughout the auditorium of 65° F. in zero weather. The velocity of the air entering the ventiducts shall not exceed 500 ft., and of the air entering the auditorium horizontally shall not exceed 350 ft. per min., unless permitted by the Supervisor of Plans. Provision may be made for reversing the above circulation for use when heat is not required. Where circumstances will not permit the installation of the above method of heating and ventilation, an approved plenum chamber system may be used.

DISTRICT OF COLUMBIA

Requirements of heating and ventilating for public buildings are by no means extensive and are contained in the Building Code of the District of Columbia.

INDIANA

Laws have been formulated for the heating and ventilating of public buildings in Indiana, but until the time of going to press no money had been appropriated for the printing and dissemination of these laws.

NEBRASKA

Safety Codes of the Department of Labor of Nebraska, under rule 43, Boilers and Pressure Tanks, contains restrictions on the construction, appurtenances and connections to steam heating boilers used in places of public assembly.

OHIO

Bulletin No. 106 of the Ohio State Building Code, Hospitals and Homes (Homes being defined as buildings used for the care and shelter of the poor, aged or children) shall be provided with heating systems capable of maintaining a temperature of 70° when the outside temperature is zero. Buildings used for open air or outdoor treatment need not be heated.

All occupied portions of the building not having sufficient natural ventilation as required under "Window and Glass Areas" shall be provided with a system of ventilation which will supply and remove not less than 1 cu. ft. of air per min. per sq. ft. of floor area.

Fresh air supply required shall be taken from the outside of the building in a clean and sanitary location above the grade line and the intake shall be screened and drained to prevent the accumulation of dirt and water.

Ventilating air shall be delivered to the room to be ventilated in a manner that will not produce drafts, at a temperature that will not lower the room temperature excessively, shall be properly directed and at a velocity to insure thorough diffusion.

Floor registers will not be permitted.

Under the same state, theatres and assembly halls are required to have one or more automatic ventilators with a joint area not less than ⅛ of the area of the stage floor. The requirements also list other regulations regarding such ventilators.

VERMONT

Sec. 6200 of the General Laws of Vermont requires that plans showing the method of heating and ventilating for public buildings must be submitted to the board set up for that purpose before the building can be erected.

WISCONSIN

Public buildings, penal institutions, dormitories and wards are included in the scope of the Heating and Ventilation Code of the State of Wisconsin, issued by the Industrial Commission of that state. These laws, which are particularly definite and detailed, are of such length that they will not be reprinted here. A copy of the code can be secured free from the Industrial Commission, Madison, Wis.

This Month's Cover

The illustration on this month's cover is of the Los Angeles City Hall. The building is of the Italian classic style of architecture, one of the most distinctive public buildings in the United States. Towering above adjacent buildings, the 452-ft. tower, surmounted by the Lindbergh beacon, is visible for many miles. Photo by Ewing Galloway, New York.

Those responsible for the design and installation of heating equipment are:

J. C. Austin, Albert C. Martin, John Parkinson, Associated Architects

J. B. Armitage and Holmes & Sanborn, Consulting Engineers

Lohman Bros., Heating Contractors

Abstracts . . .

Reviews and Summaries of Current Papers, Books and Pamphlets

Heating and Ventilation

by **John R. Allen and J. H. Walker**

Third edition, 6 in. x 9 in., cloth binding, 420 pages, illustrated. Obtainable through the publishers, McGraw-Hill Book Co., 370 Seventh Ave., New York. Price $4.

THE present edition appears in a somewhat extended form, made necessary because of the increase in the general body of knowledge of the subject. Perhaps nothing shows more clearly than does this book the directions in which the rapid increase of technical design information has moved in recent years. The greatly altered section on hot water heating, prefaced by Dr. F. E. Giesecke, contains information which was non-existent when the second edition appeared eight years ago. Also the changed text on the subjects of ventilation and air conditioning, and the greater space devoted to these subjects are necessary because of the greatly increased data, and the different design conception of the relation of the body to its air environment which have come into being from the standpoint of practical use within very recent years. Other sections, on the other hand, remain virtually unchanged as but little new information or new methods have developed.

A vexing problem in the preparation of such a textbook is to so condense and arrange the material as to keep it within a length which can be accommodated in the time available for a college course. In spite of the expansion of pages the present edition is still within reasonable teaching bounds.

Excellent judgment is displayed both in the selection of subject matter and in the method of presentation. In the main, principles are treated rather than methods—always a desirable feature in a college textbook. Moreover, the authors have succeeded in stating facts without leaning strongly toward one method as opposed to another. Such an attitude is of immense value to the student of principles rather than of methods. Usually he forms his own beliefs and his own likes and dislikes all too rapidly. Textbooks are not the proper place for propaganda methods.

Few college teachers can do better than to adopt the present edition for the standard college course.

• • •

Standard Manual on Pipe Welding

Prepared by committees of the Heating and Piping Contractors National Association and S. Lewis Land, its educational director. 280 pages, well illustrated, 5 in. x 8 in. with flexible cover. Obtainable through the office of the association, 50 Union Square–East, New York. Price $5.

UNDOUBTEDLY the most complete and comprehensive book published to date covering current practice in the use of oxy-acetylene for the welding of steel and wrought-iron pipe. Written in a clear and simple style, it contains information of value to architects, engineers, contractors and mechanics. While emphasis is laid on the tools, equipment and manipulative methods and procedures used in the actual processes of pipe welding, and which are necessarily of most interest to mechanics and apprentices, a considerable amount of space is devoted to data, template dimensions, testing methods, and full copy of the specifications for the welding of piping which will prove of interest to architects and engineers.

The publication is distinctly what its title states it to be —a manual—and one so thoroughly excellent that everyone interested or concerned with the use of oxy-acetylene for pipe welding should be in possession of a copy. In true manual style, it presents no particularly new or undisclosed information but it does collect into one set of covers much information from hitherto scattered locations, collates it, and reduces much of it to strictly usable terms. In view of the rapidly increasing use of pipe welding and the lack of a comprehensive treatment of the subject, the appearance of the manual is extremely timely.

• • •

Measurements for Pipe Tradesmen

by **Edward Bittel**

Flexible bound booklet of 104 pages, 4½ in. x 6¾ in., published by the author. Price $2.50.

THIS booklet contains a thorough treatment of the methods of measuring pipe preparatory to its fabrication. It is profusely illustrated and written in clear, concise language. While its principal usefulness is undoubtedly to the tradesman, as its name indicates, still some of the information will no doubt prove of value to engineering estimators and to quantity surveyors.

• • •

Recent Progress in Air Conditioning

by **Willis H. Carrier**

Paper presented at the Midwest Power Conference, February, 1931.

AFTER reviewing the development of conditioned air, the author presents figures to show the present extent of its use. He estimates that in industrial uses the refrigeration required amounts to an aggregate of more than 40,000 tons, requiring more than 50,000 hp. at peak. Comfort uses are estimated to require more than 75,000 tons of refrigeration and more than 90,000 hp.

An extended review of the data available for certain comfort design requirements is included, followed by a descrip-

tion of some of the mechanical and engineering requirements. In connection with these requirements and their determination, the author states that the importance of the sun's heat on the surface of the building should not be lost sight of and should be included in computing the load. He estimates that the heat from this source may amount to as much as one-third of the total in the case of office buildings.

The cost figures presented show that the author finds that in an office building completely conditioned, the plant initial cost will be increased by about 50% over that of a completely heated and ventilated building. He also estimates that a fair basis of division is to consider that one-third of the initial cost is chargeable to heating, one-third to ventilation, and one-third to refrigeration.

Perhaps the most interesting data included in the paper are those in the accompanying tabulation:

Type of Building	First Cost per Sq. Ft.	Unit Costs (Based on annual overall costs)	Annual Overall Cost per Sq. Ft.	Annual Power Costs (Rate in Parenthesis)
Department Store 160,000 sq. ft. 6,250 people	$1.80	32c. per yr. per sq. ft. of sales area	32c.	$15,923 (3c. per kw.-hr.)
Office Building 325,000 sq. ft. 2,540 people	$1.25	1c. per man hour	19c.	$13,896 (1.2c. per kw.-hr.)
Plant Office Building 42,560 sq. ft. 300 people	$2.00	3c. per man hour	31c.	$2,694 (3c. per kw.-hr.)
Restaurant and Cafeteria 12,644 sq. ft. 760 people	$3.60	1c. per meal	$1.16	$4,748 (3c. per kw.-hr.)
Hotel (Guest Rooms) 120,000 sq. ft. 600 people	$1.50	20c. per room per day	50c.	$13,600 (3c. per kw.-hr.)

• • •

Schoolroom Ventilation of the Last Forty Years

by **D. D. Kimball**

Fortieth anniversary issue of THE AMERICAN SCHOOL BOARD JOURNAL, *March*, 1931, *page* 57. *About* 1400 *words*, 1 *photo.*

A BRIEF review of the changes which have taken place in the practice of schoolroom ventilation. The author points out that the use of the 30 cu. ft. standard is based on the carbon dioxide theory. He seems to feel that but few changes from present methods are in sight.

• • •

Designing Heating and Ventilating Systems

by **Charles A. Fuller**

Third edition revised and enlarged, 244 *pages*, 5¾ *in.* x 8¾ *in., flexible binding. Published by Scientific Book Corp., New York. Price* $3.00 *net.*

THIS new edition serves to bring this long-used book up to date in many respects. The author has accomplished well his implied intention of making the book useful to those who want either an elementary text or a concise reference book. It is still a straightforward exposition of the traditionally accepted design material, and while much of the more recently developed information is omitted, it is quite apparently done with the idea of maintaining brevity and simplicity of treatment. Enough has been added to the book, however, to include at least some data or some discussion on practically all of the more recent changes which have come about since the last previous edition.

• • •

Smoke and Dust Abatement

by **Melvin D. Engel**

A.S.H.V.E. paper, annual meeting January, 1931. *About* 5000 *words*, 18 *figs., a bibliography of twenty titles appended.*

A DESCRIPTIVE paper. The problem of abatement is divided into three parts, viz.: smoke, dust and noxious gases, and while each is treated separately, by far the greatest space is given to dust abatement. Much of the paper is occupied by a description of devices and apparatus available and in use for separating dust from boiler and furnace gases, and particularly applicable to the gases from central station furnaces.

• • •

Air Pollution from the Engineer's Standpoint

by **H. B. Meller**

A.S.H.V.E. paper, annual meeting January, 1931. *About* 4500 *words, no illustrations.*

A THOROUGH-GOING discussion of air pollution, handled descriptively rather than from the chemistry of combustion standpoint. While much stress is laid on the products of combustion from heating and power stacks, other pollution sources are also discussed. Some of the effects of the foreign substances in the air are also described. The author believes that the engineer is the one who will ultimately be called on to solve the problem of air pollution.

The paper closes with the statement: "It seems to the writer that the necessities for a hygienically-clean atmosphere, and not one merely free from visible smoke, may be grouped about as follows:

(1) Solids not be discharged from stacks as at present. Similar elimination or neutralization of noxious and obnoxious gases. Once these impurities are in the air, they cannot be controlled.

(2) Control of automobile exhausts, so that the present large volume of products of incomplete combustion from this source shall be eliminated.

(3) Such methods of street and roof cleaning, and care of railroad rights of way as will reduce to the minimum the amount of dirt that can be picked up and carried by the wind.

(4) Reducing to the minimum the bare spaces from which dirt may be picked up.

Pipe Lines for Fuels Other than Fluid

SPEAKING before the Des Moines, Ia., Chamber of Commerce, President Budd of the Great Northern Railway Company is reported to have said: "One characteristic of pipe line transportation does seem quite definite, and that is that only fluids can be handled advantageously. This is important, and with the necessity for fairly uniform load seems to place such limitations on pipe line operations that their probable future influence on the railways at least can be estimated."

Investigations have shown that a number of what might be called "quasi" fluids can be carried by pipe line provided the tonnage is sufficiently great. Instances of transportation of such materials by pipe line over short distances are numerous. A few years ago it was shown that coal could be carried by pipe in a stream of water. There is no technological reason why powdered coal should not be carried by pipe in a stream of air whenever the tonnage to be transported reaches a sufficient volume. The complete problem is, of course, not an easy one, and storage and metering devices will have to be developed. It will then be merely a question of comparative cheapness: lump coal for stokers brought by rail in gondolas, the same lump coal pulverized at the plant, or powdered coal prepared at the mine and delivered by pipe line.

Practically any material in powdered form can be handled by pipe line provided the volume of business is sufficiently large. For example, a considerable amount of cement is manufactured in the Pittsburgh district as a by-product of steel manufacture. Much of this cement is consumed in Philadelphia and New York, and here again there is no technological reason why it should not be transported by pipe in a stream of air. It is not necessary that the same concern should both make the cement and own the pipe line; the latter could easily be a common carrier, provided the grades of cement were properly standardized.

Going further, it is found that it is not at all necessary that the material should be in the form of a fine powder. It has been reported that experiments are being made on conveying grain by pipe, which would be of immense advantage in that the milling would be done close to the centers of consumption and the amount of spoilage in transportation, which is quite high in the shipment of flour, would be greatly reduced.—*Mechanical Engineering.*

Next Month—

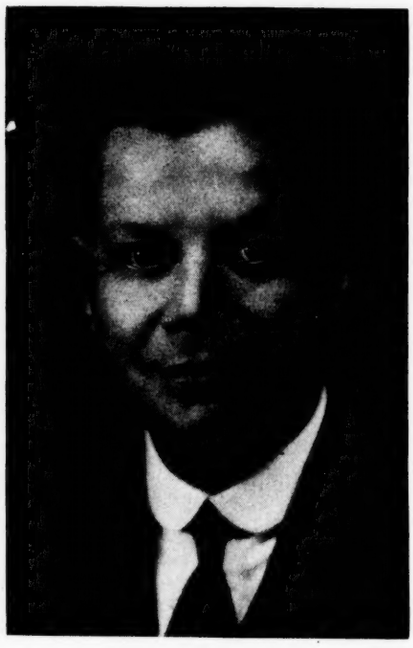
An Article on Radiant Heating

IN the next issue, T. Napier Adlam, a noted British authority on the subject, writes an article on radiant heating—its theory and applications in Great Britain.

Mr. Adlam has done considerable experimental work in radiant heating, including pioneer work with warm-air methods of floor heating, which has been applied so successfully by G. N. Haden & Sons to one of England's largest cathedrals.

He is a graduate of Swindon Engineering College, won the Whitworth Exhibition, and has received over fifty South Kensington certificates for mathematics, chemistry, physics and allied engineering.

During the war he was in charge of munition work and special heating and ventilating contracts in connection with aircraft works, arsenals, etc. Following the war he was works superintendent and manager for a prominent English manufacturer, and more recently was in charge of the heating and mechanical section for Edward and Shaw, consulting engineers of Birmingham.



T. Napier Adlam

Mr. Adlam is a member of the Institution of Heating and Ventilating Engineers and the British Institution of Patentees. He has patented eight inventions relating to pumps, heating systems, etc.

Due to his long association with this subject, Mr. Adlam is well qualified to present this material. Radiant heating is coming more and more to the front in this country, as evidenced by a recent installation, described in this publication. American engineers will undoubtedly find much of interest and value in the article.

News of the Month

Code for Pressure Piping

A chapter dealing with the fabrication details of hangers, supports, anchors, sway bracing, and vibration dampeners has been completed recently by the subcommittee on fabrication details of the sectional committee on the Code for Pressure Piping of the A.S.M.E. The section on fabrication, of which this chapter forms a part, will include in addition, fabrication details for joints other than welded, pipe bends, power piping and a chapter on welding. The entire Code for Pressure Piping, when completed, will contain sections on power piping, hydraulic piping, gas and air piping, refrigerating piping, oil piping, piping materials and identification and fabrication details.

Copies of the chapter on fabrication details of hangers have been widely distributed to industry for criticism and comment and as this release is in tentative form, the committee will welcome comments. Additional copies are available for review and may be obtained by addressing a request to C. B. LePage, assistant secretary, A.S.M.E., 29 West 39th St., New York, N. Y.

Contractors Protest Ohio Ruling on Sheet Metal Ducts

The Ohio Board of Building Standards, a body created under the state building code, and whose members are appointed by the governor, recently passed a ruling, known as Rule No. 15, which virtually eliminates all sheet metal duct work from school buildings. The ruling becomes a law when filed with the secretary of state without further formalities. Opposed to the ruling at the hearing in January were such bodies as the National Warm Air Heating Association, the Ohio Sheet Metal Contractors Association, the State Board of Health, the State Fire Marshal, the State Board of Fire Underwriters, and many individuals. The rule, nevertheless, was filed with the secretary of state and attempt made to put it immediately into effect.

The law requires that rulings of the board be advertised in advance of a hearing. The rule No. 15 which was passed by the board in January and duly filed with the secretary of state is not the one which was advertised by the board, but an amendment of the one advertised. The Ohio Sheet Metal Contractors Association thereupon petitioned the board for a hearing on the rule which it has passed, declaring it illegal to put the rule into effect. The board then called another meeting of its body, declared itself out of order and issued call for a hearing on the rule, to be held later.

However, since the association expects no relief from the hearing of the board later, it has caused to be introduced in the legislature bills for the abolition of the board.

The rule in question follows:

The method of ventilation which discharges the air from schoolrooms of fireproof structures (except chemical laboratories, chemical lecture rooms, cooking rooms, shops and toilet rooms) at or near the floor of the room and thence into the corridor not less than 7 ft. above the floor by means of openings with suitable controlled louvers and offset ducts and/or flues of the proper size to remove the required quantity of air introduced into the room per minute, and thence from the corridor through toilet rooms and through ducts and/or flues, or directly, to the outside, is hereby declared to be the equivalent as regards safety and sanitation of the requirements of that portion of section 12600-64 General Code which reads as follows: "The vitiated air shall be conducted through flues or ducts to and be discharged above the roof of the building."

Names of Architects and Engineers Required on Los Angeles Plans

Names of architects, engineers or other persons by whom they are made, are now required on all plans filed with the Los Angels city building department. Following is the text of a law section in the Los Angeles Building Ordinance covering the subject:

Section 3½. Architect or Engineer Required. (a) Every plan and/or drawing, and every sheet thereof, filed in the office of the Department of Building and Safety, shall bear the signature or seal of a certificated architect having a certificate as provided in an act of the State of California, known as, "An act to regulate the practice of architecture," approved March 23, 1901, as amended by

San Francisco's most elaborate and unique amusement adventure, the Caliente Miniature Golf Course, recently completed at a cost of approximately $100,000, *includes five immense outdoor fireplaces, especially designed for their unusual effect and for the convenience and comfort of the patrons of the course where one can relax in front of a crackling log fire at any time during or after the game and enjoy the food service of the course. . . . . The fireplaces are constructed of stone and are* 16 *ft. in height and* 16 *ft. square at the base.*

News of the Month

chapter 68, Statutes of 1929; or shall bear the signature or seal of a licensed engineer having a license as provided in an act of the State of California, known as "An act regulating the practice of civil engineering," approved June 14, 1929, chapter 801, Statutes of 1929; excepting as otherwise hereinafter provided in this section.

(b) The provisions of this section shall not apply to any person, firm or corporation making and/or preparing, or supervising the making and/or preparing, of plans or drawings for any building, structure or work for such person, firm or corporation, in the event that there is a statement to such effect on each sheet of such plans or drawings.

(c) The provisions of this section shall not apply to any plan or drawing for only architectural purposes, in the event that every sheet thereof contains a statement to the effect that the person, firm or corporation making and/or preparing, or supervising the making and/or preparing of such plan or drawing, has notified the owner or other party for whom such plan or drawing was made, prior to the making of such plan or drawing, that such person, firm or corporation is not an architect; or in the event that such person, firm or corporation uses the title of "structural engineer" on each sheet of such plan or drawing.

(d) The provisions of this section shall not apply to any plan and/or drawing which does not include any architectural design and/or engineering.

(e) The provisions of this section shall not apply to any plan and/or drawing for a building used exclusively as a one or two-family dwelling, including the necessary buildings and/or structures for any such dwelling, in the event that no one such building exceeds a value of ten thousand ($10,000) dollars.

(f) The provisions of this section shall not apply to any plan and/or drawing for any building and/or structure, in the event that the total value of such building or structure, to be erected or existing, does not exceed one thousand ($1000) dollars.

(g) The provision of this section shall not apply to the government of the United States of America, or to any department office, officer or employee thereof, acting in official capacity for said government.

Smoke and Dust Becoming a Serious Problem

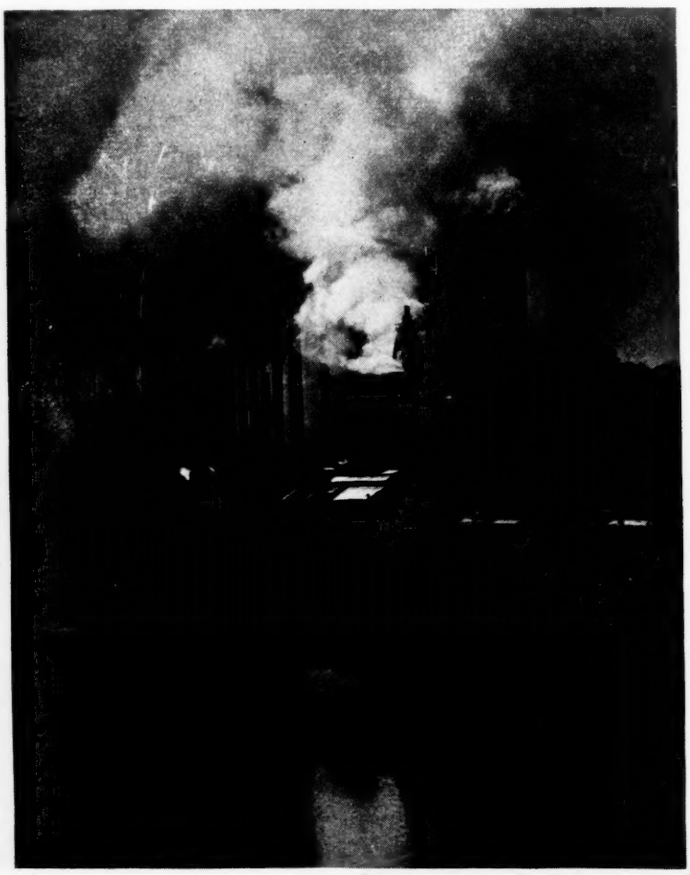
According to Dr. Shirley W. Wynne, health commissioner of New York, the citizens of that city are losing $90,000,000 a year in removing accumulated smoke on buildings. However, Eugene F. Moran, president of a harbor tug company, says that no ordinance that he can conceive can take the smoke out of bituminous coal. He points out that the city administration is about to spend millions of dollars on new and modern piers to accommodate superliners and encourage commerce, and makes a sarcastic comment that there are idealists who think we can get along without commerce, that our open piers should be turned into bungalow sites and covered piers turned into hanging gardens and artists' studios.

According to Prof. A. H. Sheldon, of New York University, 5 to 10 tons of solid material hang in a constant cloud above New York. This is based on an estimate made from studies by Professor Sheldon at Times Square. He worked with an apparatus which in one week filtered 341,250 cu. ft. of air. Out of that amount he got 35 lb. of dust, smoke and general microscopic debris.

John Aiken, a scientist in Edinburgh, Scotland, has estimated that a cubic inch of air in large industrial cities contains from 1,312,000 to 3,444,000 particles, as compared with 100,000 particles of dust which the United States Weather Bureau has found present in open country air under normal conditions.

The United States Public Health Service reported last November that the smoke pall above lower Manhattan caused an average of 21.5% loss of daylight.

In a study of smoke damage to store merchandise, personal apparel, exteriors of buildings and interiors of homes, R. D. McLaurin, commissioner of trade waste in Cleveland, Ohio, declared recently: "There is no difficulty in collecting smoke at its source either by electrical precipitation or bag filtration. The latter method is rapidly being recognized as eminently satisfactory .... It is obvious that air cleaning for ventilating purposes has no bearing on the prevention of property damage. It is equally obvious that such property damage can best be prevented by collecting smoke at the point of origin."



Ewing Galloway

A Pipe Mill Near Pittsburgh, Pa.

Wisconsin Adds Correspondence Sheet Metal Course

A course in sheet metal drafting has been added to the correspondence study program of the University of Wisconsin Extension Division at Madison to supply the necessary background in mathematics and drawing to enable sheet metal workers to lay out their own patterns for a job.

The new study subject giving this specialized training is conducted by

News of the Month

R. W. Fowler, assistant professor of mechanical engineering, and is based on a text prepared in the extension division by Ellsworth M. Longfield, formerly head of the sheet metal department of the Boston Trade School.

Because most workers enter this craft with not more than an elementary knowledge of mathematics, and few have drawing experience, they are handicapped in advancing in it until the needed technical preparation has been acquired. The extension course, according to the preliminary outline, has been prepared to help them to overcome these difficulties by providing instruction in the fundamental principles and many of the standard problems encountered in sheet metal work.

Engineers Recommend Elimination of "Or Equal" Clause

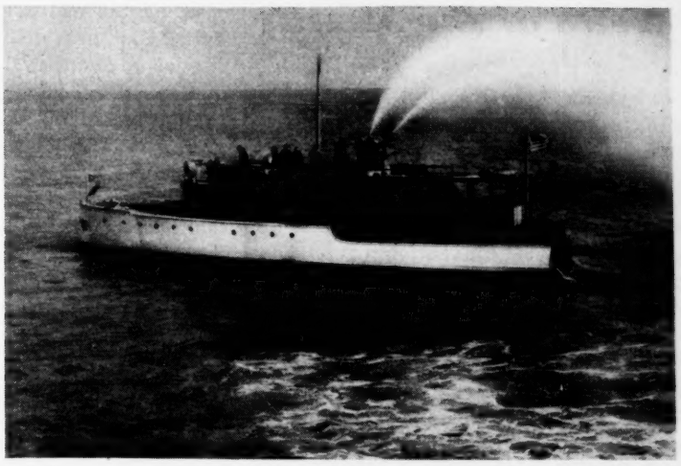
The New York Association of Consulting Engineers has recommended to its members that their specifications should be so drawn as to eliminate as completely as possible the use of such expressions as "or equal" and "or equally approved." The association believes that the interests of the job itself, and of all of those connected with it, can best be served by making the specifications as definite as possible, and by calling by name for articles of one make (or more than one make, if actually equivalent in quality, performance, and adaptability to the conditions of the job).

Minneapolis Prepares for Cooperation Between Coal and Heating Industries

An enthusiastic gathering of the Coal and Dock Operators of the Northwest was held at the Minnesota Club in St. Paul, February 18, for the purpose of forming a local Twin City organization to further the Committee of Ten Coal and Heating Industries movement in Minneapolis and St. Paul.

While the conference consisted principally of the local operators, there were present also invited representatives of the boiler, furnace and allied heating industries.

The meeting was presided over by J. A. Maher, manager of the Maher Coal Bureau, St. Paul, Minn.



Fire-Fighting Yacht, Heated by Electric Water Storage System

A.S.A. Safety Code for Mechanical Refrigeration Available

A manual of 32 pages has been published recently by the American Standards Association, 29 West 39th Street, New York, under the title "American Standard Safety Code for Mechanical Refrigeration." The code is the result of a movement sponsored by the A.S.R.E. through the A.S.A. It received the approval of the association in October, 1930, and now appears as an "American Standard." It has already been adopted by several cities and is being considered by others.

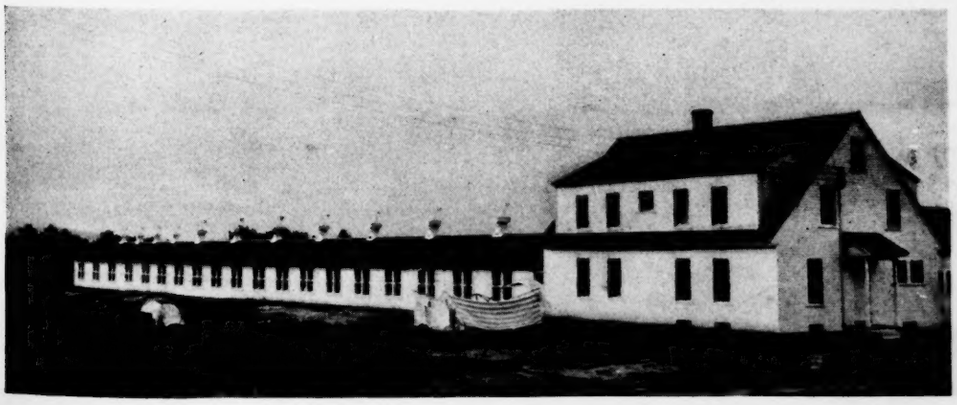
The manual is well and clearly prepared and contains a history of the code and its development, a list of the personnel of the committee, and the code itself. The code is presented in five separate sections each complete in itself. This plan of presentation makes for simplicity in language, and permits the requirements to be stated briefly, since a separate section is devoted to definitions and to the classification of the systems. A notable feature is a chart showing the paragraphs of the code which cover the requirements at each point in a system. A tabular index is also appended for quick and easy reference.

As this code covers the safety requirements for mechanical refrigeration for use with air conditioning and as it is likely to be widely adopted it should receive attention from all interested. Copies of the manual may be obtained by addressing the American Standards association and is priced at 30 cents per copy.

Heating and Piping Contractors to Meet in Louisville

The forty-second annual convention of the Heating and Piping Contractors National Association will be held in Louisville, Ky., May 6-9. Rooms for those who attend the convention have been reserved at the Kentucky Hotel and the Seelbach Hotel. Sessions of the convention will be held in the ball room of the Kentucky Hotel.

At the Pittsburgh meeting the Board of Directors of the national association approved what promises to be a most interesting and instructive program. The opening session on Wednesday



The State of Maine Experimental Poultry House Heated with Oil to a Temperature of 42°.

News of the Month

morning will be devoted to the addresses of welcome, the president's address, the appointment of convention committees and otherwise getting the convention machinery set up and going.

Committee reports on the technical work of the national association will be presented at the second session.

The Thursday morning session will be given over to the committee on trade promotion. One of the features of this session is the survey of the heating industry which is now being made and the results of which will be given in graphic form at Louisville. Those who listened to the discussion of the survey of the heating industry at the New York last year know that it was one of the most vital discussions of the entire convention.

Another feature of this Thursday morning session is a period set aside for a general discussion of ways and means of trade promotion in which manufacturers and jobbers, as well as heating and piping contractors, are invited to take an active part.

Friday morning's session will be devoted to the reports of convention committees, a report on welding with a demonstration of welding, and the election of officers.

Battelle Memorial Institute Carries on Research in Fuels and Metals

As the result of a bequest left by Gordon Battelle, The Battelle Memorial Institute has been erected in Columbus, Ohio, and equipped with the best apparatus obtainable for carrying on research in metals, fuels and allied fields. Under the instructions of the will and with funds provided by the endowment, service to industry leading to discovery and invention is also provided through the sponsored research plan, whereby a project may be conducted at the institute under the sponsorship of individuals, companies, trade associations or groups. Conforming with the spirit of the bequest, the trustees do not aim to take profits from industrial research projects, though they do expect such projects to be supported by the sponsors.

It is the aim of the institute to be prepared to deal with any problem relating to ferrous or non-ferrous metallurgy, or to coal, gas, petroleum, and other fuels, and to concentrate attention on these general fields, taking such allied projects as the problems demand.

As a rule, no research problem will be accepted which will not require the full time of a research engineer for at least one year, because competent research workers cannot usually be obtained to work for shorter periods.

The institute contains 90,000 sq. ft. of space and contains, in addition to the laboratory, an auditorium, museum, library and administrative offices.

Anthracite Laboratory Issues List of Approved Stokers

Dated March 1, the first list of approved automatic stokers designed for burning Pennsylvania anthracite was issued by the Anthracite Institute Laboratory, Primos, Pa. Approved appliances will carry the seal of approval of the laboratory, the seal consisting of a diamond shaped outline with a red A and I, between which are the words "Approved by the Anthracite Institute Laboratory."

Stokers so far approved include: The Electric Furnace-Man and MotorStokor, both of the underfeed type; Losch automatic furnace, of the side feed type, and the Auto-Coala and Phantom stokers, of the overfeed type. The Electric Furnace-Man, Losch and MotorStokor have ash removal facilities while the MotorStokor can also be furnished with an auxiliary device for conveying fuel from the coal bin to the hopper.

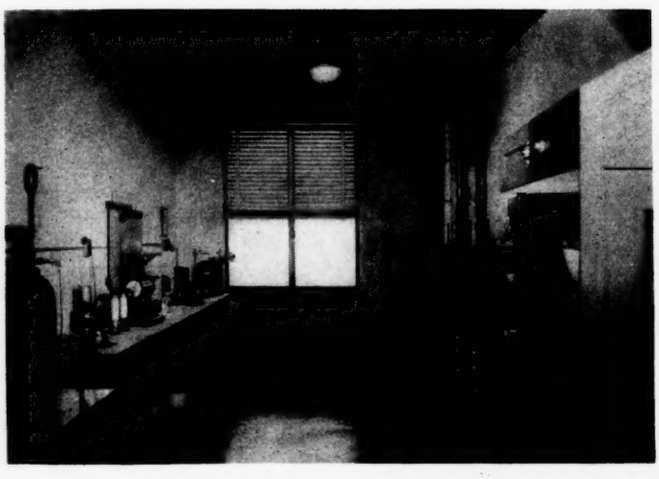
In addition to approved stokers, the laboratory has approved other accessory equipment for anthracite-burning installations. Approved devices of this class include: Thermostatic equipment —Minneapolis-Honeywell, Master thermostat, Time-O-Stat, Sheer heat control and Wexler damper motor. Vacuum cleaners—Sturtevant and Kent. Blower systems—Vulcano and Ace. Service water heaters—Taco heater and Corbin magazine feed heater.

The purpose of the seal of approval is to enable the public, through the medium of retailers and manufacturers, to secure the maximum possible results from the use of hard coal. The laboratory, which was opened last summer,* is working on studies of combustion, coal feed from the bin to the stoker hopper, special grates, and other problems, the solution of which will, it is hoped, make anthracite a completely automatic fuel.

District Heating Plant for North Tonawanda

Permission to construct a central steam station in North Tonawanda, N. Y., has been granted to Arthur J. Slade by the New York Public Service Commission. Mr. Slade proposes to organize a steam corporation and undertake the construction and operation of a steam plant and distribution system to furnish steam for heating and power. This permission is contained in a 25-year franchise granted by the city which is to have first choice for the use of the steam in schools and other public buildings. Mr. Slade is to pay the city 2½% of the gross receipts from the sale of steam

*A complete description of the laboratory appears on pages 109-111, HEATING AND VENTILATING, October, 1930.



(Left) Fuels Laboratory and (Right) Pulverized Fuel Equipment, Battelle Memorial Institute

News of the Month

and the city reserves the right to purchase the plant under certain conditions.

No steam is now furnished to the public in North Tonawanda. The franchise covers the entire city but construction is to be begun in a limited district surrounding the city hall, which is a well populated residential area. It is proposed to charge about 50c per 1000 lb. for the steam.

New York Bar Endorses Metric System

The report of a special committee of the Association of the Bar of the City of New York favoring the use of the metric system of weights and measures was recently adopted by the association.

The resolution was passed on the grounds that the present system is archaic, inconvenient and inconsistent with the systems used by other nations. Copies were sent to the senators and representatives from New York.

Record Number of Exhibitors for Oil Burner Show

Eighty oil burner and accessories manufacturers are expected at Philadelphia April 13-18, 1931, for the eighth annual convention and oil burner show, according to Harry F. Tapp, executive secretary of the American Oil Burner Association, who reports that 72 exhibitors have already signed up for 120 booths.

Philadelphia convention headquarters will be at the Benjamin Franklin Hotel. Show headquarters will be across the street in the Gimbel Building. There will be no admission charge to the show. Everyone will register and be provided with a pass good for the entire week. Members of the association will be given special registration cards for their authorized employees. Arrangements have been made with railroads for reduced fares on the certificate plan.

The convention will open on Monday, April 13, with meetings of the executive committee and the board of governors of the A.O.B.A. The oil burner show will open at 7 p.m. that evening in the Gimbel Building and will be open from 1:30 p.m. to 11 p.m. every day thenceforth until Saturday, April 18.

The annual meeting of the association, for members only, will be held on Tuesday morning. A special open meeting for dealers will occupy Tuesday afternoon.

Merchandising sessions will begin Wednesday morning under the chairmanship of Earl Marr, president of the Marr Oil Heat Machine Corporation. Addresses by Haldeman Finnie, vice-president and general manager of the Timken-Detroit Company; Lionel J. Jacobs, president of Electrol of New Jersey; H. Barley, vice-president of the Enterprise Oil Burner Company, and A. J. Fleischmann, treasurer of the May Oil Burner Corporation, will be followed by an open forum.

On Thursday the merchandising sessions will be continued, with John A. Berghoff, general manager of the Wayne Home Equipment Company, in the chair. H. B. Dexter, assistant sales manager of the Petroleum Heat and Power Company, J. Stowell, National Warm Air Heating Association, and J. T. Foley, chief auditor of the Richfield Oil Corporation, will speak.

The annual banquet and dance will be held Thursday night in the Crystal Ballroom of the Benjamin Franklin.

Friday morning there will be an engineering session of which John H. McIlvaine, president of the McIlvaine Burner Company, will be chairman. Speakers will include: P. S. Russell, Detroit Lubricator Company; J. T. McTarnahan, general manager of the Holby Burner Corporation; Wiley Butler, Standard Oil Company of New Jersey, and Prof. L. E. Seeley of Sheffield Scientific School, Yale University.

Over-due Accounts to be Listed by Heating Board

The first list of over-due accounts will be distributed among the members of the Heating Board of Trade of New York about April 12. This will be the beginning of a service of collecting and distributing information with reference to long-due accounts in the heating and ventilating industry for the purpose of having currently-available data indicating those who are delinquent in the payment of obligations. The intent of this program is to reach an understanding as to the time of reporting over-due accounts in the various groups of like businesses, and to gather, tabulate and distribute data with reference to accounts based on this.

All members who supply information on over-due accounts will mail into the office of the board each month the names, addresses and amount due on their books from buyers who are over-due.

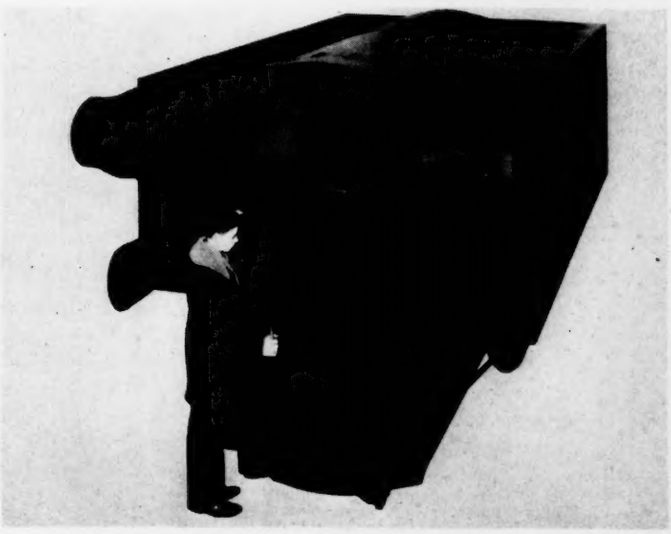
Heating Board of Trade to Incorporate

It is planned to incorporate the Heating Board of Trade of New York under the laws of the State of New York. The present name will be continued. Incorporators will be: Werner Nygren, R. A. Wolff, A. P. Keasbey, J. G. Eadie and W. G. Le Compte.

Says Liquid Coal is Only Hope of Coal Industry

According to a recent announcement by Dr. Thomas S. Baker, president of Carnegie Institute of Technology, the coal industry all over the world is in a desperate plight, without hope for the future unless industry adopts a "liquid coal."

According to Dr. Baker the public can hardly realize the immense amount of research that is being carried on in connection with soft coal even in some countries which have no fuel resources. The newspapers sometimes report sensational discoveries such as that of the liquefaction of coal by the German scientist, Doctor Bergius, but one is not aware of the fact that in scores of laboratories patient investigations are being made in a dozen countries.



A Five-Ton Warm-Air Furnace Built for a Church in Minnesota Contains over 582 Ft. of Electric Welding.

News of the Month

"The main objective," Dr. Baker said, "is to secure greater value for this product of nature. In other words, scientists regard coal as a raw product from which a variety of useful commodities can be secured, in addition to its use as a combustible.

"In spite of the political unrest and lamentable economic situation, laboratories with most efficient staffs and equipment are proceeding patiently, and in some cases brilliantly, with their studies of all the phases of combustion and utilization of combustibles."

Mechanical Handling Exposition to be Held in November

What is expected to fill an important industrial need has been announced for the week of November 30—December 5, in Grand Central Palace, New York. This is to be the first National Exposition of Mechanical Handling, an initial effort to feature exclusively this special type of equipment.

A list of tentative exhibits includes fuel and refuse handling, ash hoists, conveyors, barrel making machinery, blocks, brakes, chutes, containers, conveying equipment, engines, folding and closing machines, forming, drying and seaming machines, gravity conveyors, haulers, hawsers and rope, labels and brands and stencils, lithography, lubrication systems and lubricants, motors, packing and packaging machines, platforms, pumps, production machines, recording instruments, shipping room equipment, transmission equipment, transportation, unloaders, weighing machinery, and miscellaneous material.

Hospital Building is Advocated to Aid Employment

Out-patient departments of public hospitals are being taxed to capacity as the result of economic conditions and additional facilities or improvements are needed, Dr. Paul H. Fesler, superintendent of the University of Minnesota hospitals and president-elect of the American Hospital Association, declared recently in an address under the auspices of the President's Emergency Committee for Employment.

Dr. Fesler's address was delivered by radio over the network of the Columbia Broadcasting System in the Committee's series of talks by leaders in the institutional field on construction among non-profit organizations as a means to stimulate employment.

The hospital is in a position to provide considerable employment by going ahead with building improvements planned at the onset of the depression, Dr. Fesler said. Hospitals rank as the fifth industry in the country from the standpoint of capital investment, he said.

He stated that:

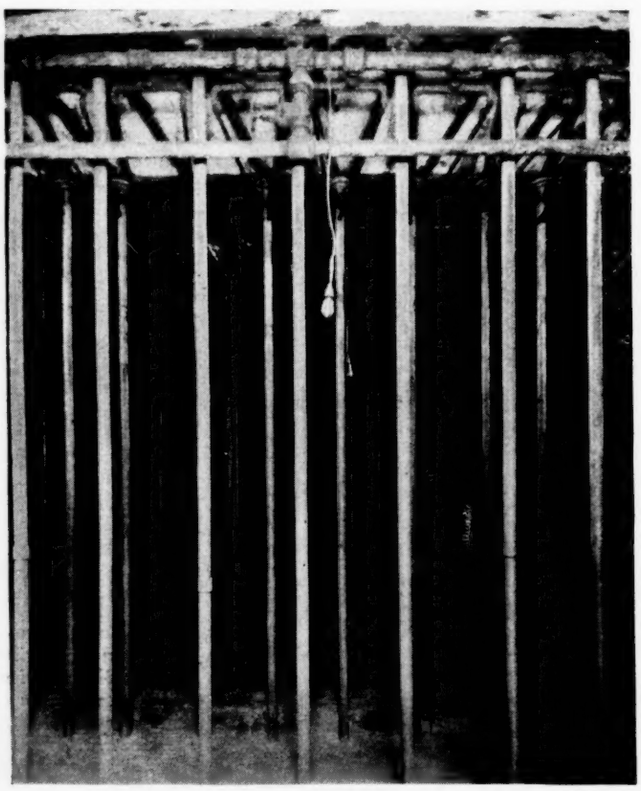
"President Hoover's Emergency Committee for Employment has requested representatives of churches, schools, colleges and universities, hospital and mental institutions to call attention to the opportunities for building programs for such institutions to aid the unemployed during the time of business depression.

"The hospital is taken for granted by most of us. The average person is interested only when a member of his family is forced to make use of it. One out of 10 of our population of 120,000,000 uses the hospital each year.

"There are 7,000 hospitals in this country containing 900,000 beds, representing an investment of more than $3,000,000,000. The hospital is fifth in the list of industries from the standpoint of capital investment. As about 90% of the hospitals are non-profit institutions, they cannot be considered a business but a service institution as important to the community as the school, police, or fire department. They must be able to serve a scientifically trained medical profession in the care of all people regardless of their social or financial standing, therefore they are public agencies and come under the head of public improvements as mentioned by our President."

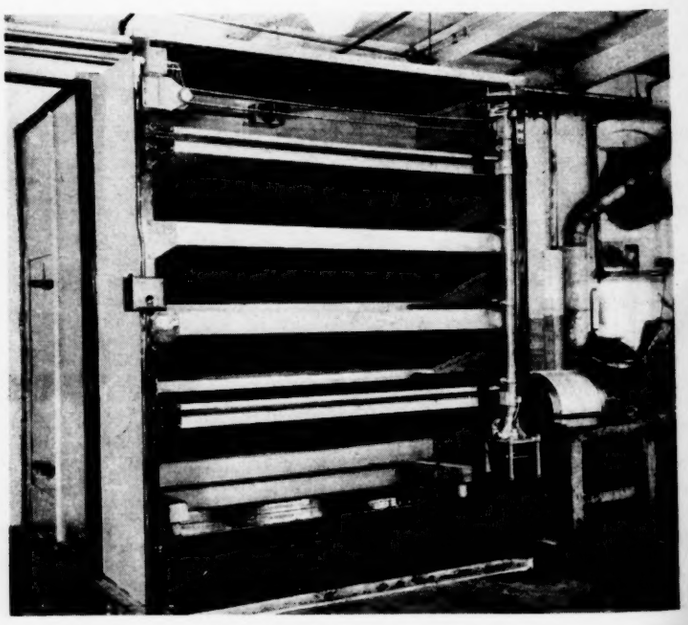
National Research Council Lists Laboratories

The National Research Council has issued the fourth edition of its bulletin listing the industrial research laboratories of the United States, including consulting research laboratories.



(Left) Cheese Cloth Air Filter Installed in New York Public Library about 1911.

(Below) Clean Air Side of a Modern Automatic Filter.



News of the Month

A 60% increase in the laboratories listed over those appearing in the 1927 edition is shown, there being more than 1600 laboratories included as compared with 1000 in the third edition.

Names of manufacturers and independent research organizations maintaining laboratories, together with the number of men included in the staff, and a brief account of the work being carried on at each laboratory are included. The book does not include laboratories connected with federal, state or municipal government or with educational institutions.

The book is completely indexed, the major part being listed alphabetically under the name of the company maintaining the laboratory, and in addition the names and addresses of the directors of research of these organizations are listed alphabetically in the appendix. Another index shows the geographical distribution of laboratories by cities and another index lists the research investigations by subjects.

Compiled by Clarence J. West and Tallie Hull, the bulletin contains 267 pages. It sells for $2.00 and may be obtained from the National Research Council of the National Academy of Sciences, Washington, D. C.

Oil Burning Ordinance Adopted by 39 Cities

According to announcement made by the American Oil Burner Association, 39 cities have adopted the model oil burning ordinance of the A.O.B.A., the latest cities to take such action being Minneapolis and New Brunswick.

Newark has the new proposed code in proof form and a public hearing will be held in the near future at which time any criticisms may be made. Mt. Vernon, N. Y., is holding up the oil burner ordinance pending preparation of similar rules relating to other types of fuels.

Committee of Ten Opens Chicago Office

Oliver J. Grimes has been chosen managing director of the Committee of Ten—Coal and Heating Industries and will devote his entire time to organizing a systematic campaign for encouraging the better utilization of solid fuels and actively coordinating the activities of the various national organizations represented by the Committee of Ten.

Offices were opened in Chicago on March 1 to serve as the general headquarters of the organization.

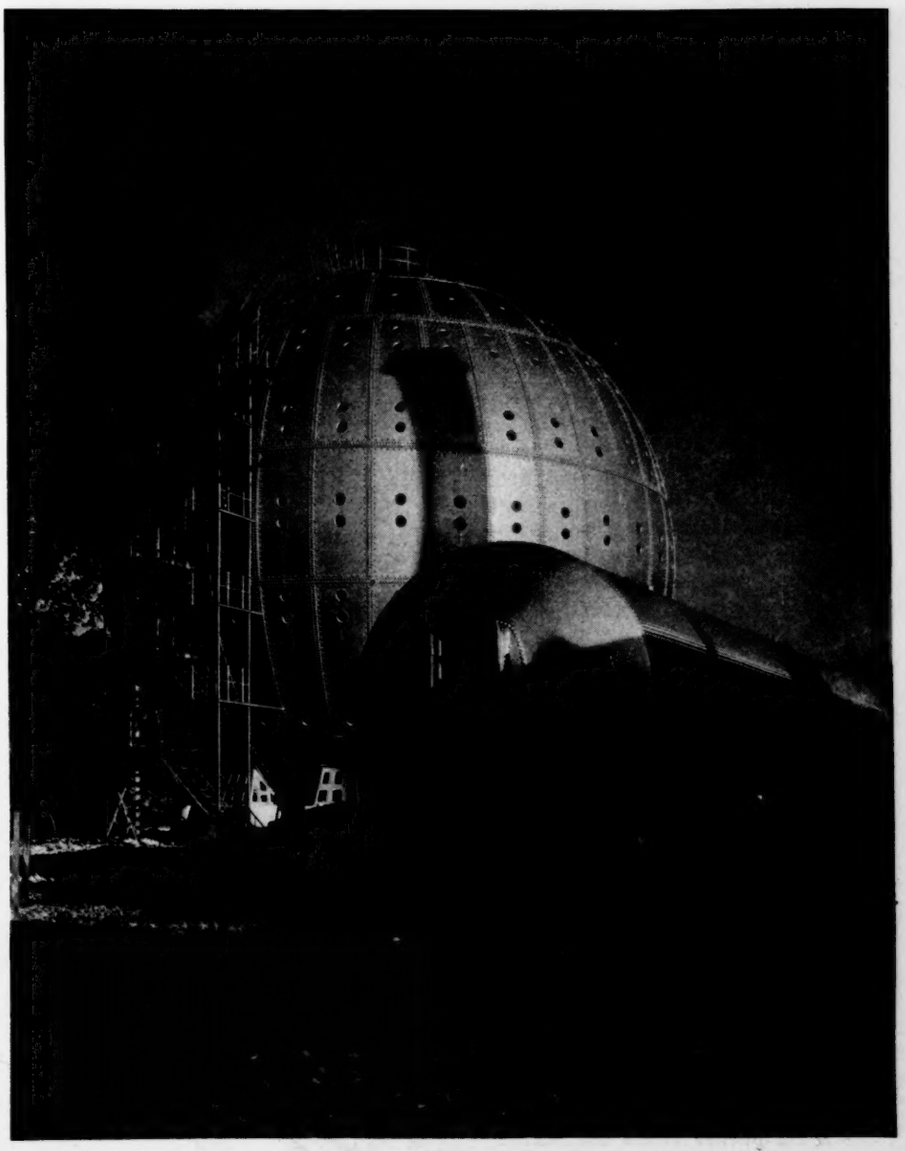
Mr. Grimes was executive secretary of the Utah Coal Producers Association at Salt Lake City for the past two years and during that time did some especially effective work in helping the coal trade present to the public the merits of using solid fuels in preference to oil and gas. He was born at Greencastle, Ind., and spent twelve years in the railroad service. After going to Utah he engaged in newspaper work and then served four years as secretary to the Governor of Utah, and also served four years as a member of the Utah State Board of Equalization and Assessment, before becoming connected with the Utah Coal Producers Association.

Widespread interest has been shown in the organization of the Committee of Ten and with the appointment of a permanent secretary active work is planned in arranging numerous local meetings in the various key cities, bringing together the leading members of the coal and heating industries and help them to solve mutual problems in giving their customers the benefits of modern heating and more satisfactory results from the use of solid fuels.

Smaller Homes Adopting Gas House-Heating in New York

The small six and seven room house in the metropolitan and suburban area is following the more luxurious residence in adopting automatic heating methods, according to figures made public recently by the Consolidated Gas Company of New York.

On January 1, 1930, in the territory served by the Consolidated and its affiliated gas companies, the average house using gas for heating contained 630 sq. ft. of radiation. On October 1 following the reduction in gas heating rates in August, this figure had dropped to 567 sq. ft., indicating the installation of gas heat in many homes of the smaller type.



Air Pressure Ward, Timpkin Hospital, Cleveland

News of the Month

The same trend was apparent in the territory served by the Westchester Lighting Company, where the figure of 600 sq. ft. on January 1 decreased to 571 sq. ft. on October 1.

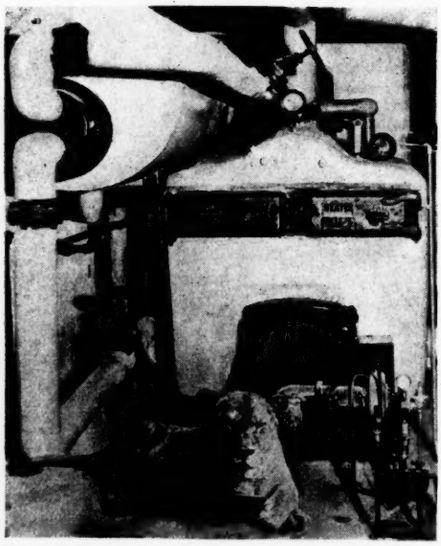
During this period, there was an increase of more than 35% in the number of gas heating installations in the territory served.

Since August 1 to the middle of November, nearly 450 house-heating installations have been sold by this company and its affiliated gas companies, serving Manhattan, Bronx, Westchester County, and portions of Queens. On November 1, there were more than 2150 homes heated with gas in the territory served.

Plumbing Code Discussed by Consulting Engineers

At the regular monthly meeting of The New York Association of Consulting Engineers, March 16, Otto E. Goldschmidt gave a brief talk on the proposed Plumbing Code of New York. He explained its general make-up and, as fully as possible, the technical differences between the old code and the new, and the theories on which they were based, following which there was a general discussion of the provisions of the new code.

There was a continuation of the discussion held at the previous meeting regarding radiant and convected heat. Whereas at the previous meeting most of the discussion had centered around convected heat, at this meeting radiant installations were the principal topics.



An Oil Burner Heats the Seattle Animal House

Serious consideration was given to two pending senate bills, Nos. 552 and 899. There was considerable opposition to the bills, but it was decided to obtain further details as to their specific wording before taking any action.

A new type of unit ventilator, using partial recirculation, was described and discussed.

H.&P.C.N.A. Initiates Merchandising Campaigns

The committee on trade promotion of the association is sponsoring a very well considered merchandising program among the members which is very broad in its scope. The full program is expected to cover a period of several years before it is fully worked out and consists of five important parts. These are: (1) A study of the efficiency of present merchandising channels, (2) experiences of heating contractors with various phases of merchandising effort, (3) collection of literature bearing on the subject of merchandising, (4) preparation of a sales manual, (5) improvements in selling personnel through training classes.

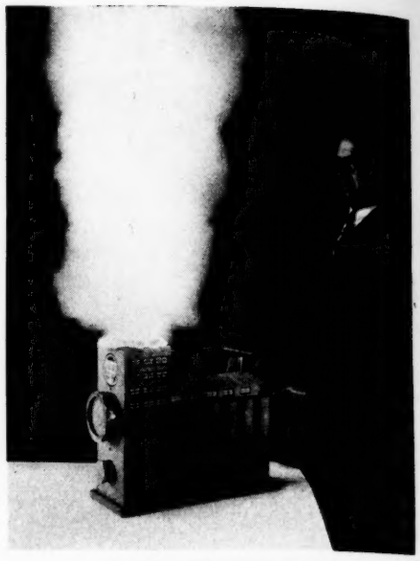
Since the full program is a long period development, the active work for the present year consists of a series of five campaigns designed to assist the members in their merchandising efforts. It is proposed that this year's plan shall be carried out with the active assistance of the local organizations throughout the country.

This activity of the association marks its entrance into a field which is new and the results and methods will be watched with much interest by the whole industry.

Range of Temperatures Over Globe is 226°

The highest temperature officially recorded in the United States during 1929 was 124°, which occurred on June 23 at Greenland Ranch, in Death Valley, Inyo County, California, 178 ft. below sea level. An extreme maximum temperature of 134° was recorded here a few years ago, the highest which has ever been recorded by the Weather Bureau in the United States. This substation is maintained in cooperation with the Weather Bureau by the Pacific Coast Borax Company.

The highest temperatures on earth occur in the deserts of the North Temperate Zone. The highest reading of a shaded and properly exposed thermometer thus far reported is 136°, recorded on September 13, 1922, at Azizia, about 25 miles south of Tripoli, in northern Africa.



Courtesy Chemical Engineering Div., Bureau of Chemistry and Soils

Miniature Grain Elevator Used in Making Studies of the Causes and Effects of Dust Explosions

The lowest temperatures on the earth occur in winter in the northeastern part of Siberia, the somewhat indefinite center of greatest cold being known as the "cold pole." At Verkhoyansk, in this region, a temperature of 90.4° below zero was recorded January 15, 1885, the lowest ever recorded near the ground at a regular meteorological station.—*From Tycos-Rochester.*

N.W.A.H.A. and Warm Air Furnace Institute May Merge

Warm-air furnace manufacturers attending the annual convention of the National Warm Air Heating Association in Columbus, Ohio, April 22-23, will discuss the proposed merger of the association with the Warm Air Furnace Institute. A study of the matter is being made by a joint committee on the merger made up of the following: Clarence Olsen, W. L. McGrath, A. W. Wrieden, H. P. Mueller, and President Wise, representing the institute, and I. L. Jones, James Brown, E. B. Langenberg, A. F. Frazee and President Triggs, representing the association.

At the dealers' session, April 22, J. C. Miles will present a paper on "Air Conditioning the American Home"; G. E. Olsen, one on "Modern Installations," and Lorin W. Smith, Jr., one on "Small Stokers as Adapted to Warm-Air Furnaces."

At the first general session, April 23, "Warm-Air Furnace Heating with Gas or Oil" will be discussed by A. M. Daniels; "Experience in Residential Air Conditioning," by V. S. Day, and "Progress Made by the Committee of Ten," by E. B. Langenberg and C. B. Huntress.

News of the Month

Fred Bishop will present a paper on "Phases of Warm-Air Heating."

C. M. Lyman will preside at the second general session and also talk on "Our Research Activity." Professors Willard and Kratz and S. Konzo will discuss "Summarized Conclusions of Latest Information Relative to Our Research Work," referring to the cooperative research being carried on at the University of Illinois by the N.W.A.H.A.

Pullman Company Issues Bulletin on Ventilation

Pullman Facts No. 6, one of a series of circulars published by The Pullman Co., Chicago, Ill., is devoted to the subject of "Scientific Ventilation in Pullmans." According to the circular, 2727 cu. ft. of fresh air are supplied per hour to each person in the body of sleeping cars, and 2027 cu. ft. per hr. per person to the berths. The carbon dioxide in parts per 10,000 of air is said to be 6.2 and 6.96 in the body of the car and in the berths, respectively. A complete change of air every 4 or 5 min. is said to take place when the car is moving 40 mi. per hr.

Three Houses to be Cooled With Gas

Announcement has been made by F. J. Rutledge, chairman of the committee on industrial gas research of the American Gas Association, that three installations of house cooling with gas will be made and operated under practical test conditions through the coming season. One of the homes will be on the Atlantic seaboard, one in the Middle West, and one in the extreme South. The eastern house is located in Pelham, N. Y., and the middlewestern one in North Chicago. Both homes are now heated with gas and with the addition of gas-operated cooling and dehumidifying will become the first houses to be completely air conditioned with gas the year round.

The system which will be used is the Silica Gel* gas air conditioning process. The principals developed during the last two years will be used with modifications and improvements in conditioning the three houses.

Fresh Air for Chicago Subway

The mechanical engineering department of the University of Illinois is conducting tests to assure proper ventilation for Chicago's proposed subway system. The work is under the direction of Prof. A. C. Willard.

The problem is to introduce 2,900,000 cu. ft. of fresh air per min. into the subway. The research indicates that towers 70 ft. high, equipped with huge electric fans, will be built along the new transit route. Fresh air will be drawn through the towers and forced into the tube, with volume and velocity automatically controlled. No air will be blown directly on passengers, Professor Willard says.

Modernization Demonstration Stimulates Business for Building Industries

As a result of a modernization demonstration held in St. Paul close to 5,000 prospects for modernizing were obtained, according to the National Building Industries Bureau. The St. Paul Building and Modernizing Bureau, one of the first bureaus to be organized, has functioned successfully for almost two years.

Early last summer the St. Paul Bureau in cooperation with the *St. Paul Pioneer-Press Dispatch* secured an old-fashioned house, the rooms of which were small and box-like. The staircase, plumbing, heating and electrical fixtures were popular a decade ago, but were entirely unsuitable for modern furnishings and comforts.

The prospects were classified as follows:

675	for general construction
1500	for oil burners
1200	for heating and plumbing
700	for millwork
600	for decorating
4675	Total

New York Fuel Oil Rules Amended

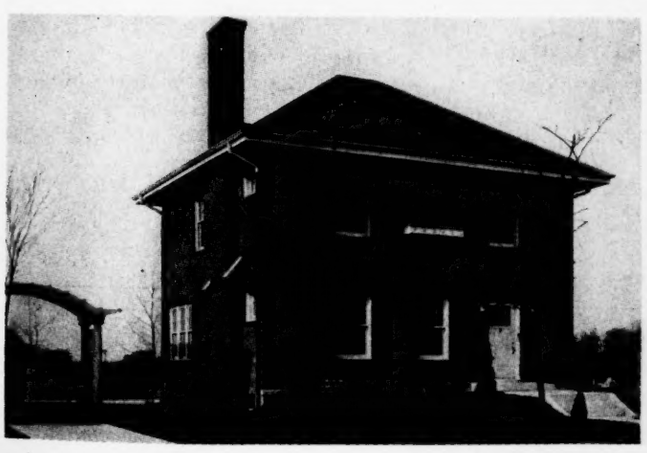
The Board of Standards and Appeals of the City of New York unanimously voted on March 20 to amend the fuel oil rules of the city to permit the installation of domestic oil burners with one unenclosed gravity feed tank 275 gal. capacity for fuel oil storage inside the basement. The amended ordinance will mean a reduction of $75 to $150 on the cost of each oil burner installed in the city. Harry F. Tapp, executive secretary of the American Oil Burner Association, who appeared before the board to sponsor the amendment, declared that the ruling would mean a saving to homeowners in New York of several hundred thousand dollars annually.

National Canadian Oil Group Proposed

Canadian oil burner manufacturers and dealers are proposing the union of local associations now formed and operating in Toronto, Montreal, Quebec and Vancouver, into a national Canadian association.

E. D. Ranck, chairman of the Oil Heating Section of the Toronto Board of Trade, stated that "The purpose of this organization would be to coordinate and standardize on installation methods

A general description of this type of equipment appeared on page 116 of HEATING AND VENTILATING *for October, 1930.*



Two of the Three Homes to be Cooled with Gas
Left—Residence in North Chicago Right—Residence in Pelham, N. Y.

News of the Month

and the various problems which arise in the development of any industry."

It is probable a committee will soon be appointed to consider the possibilities of organizing an association.

Yant New Supervising Engineer of the Pittsburgh Bureau of Mines

W. P. Yant has been appointed supervising engineer of the United States Bureau of Mines Experiment Station in Pittsburgh to succeed G. St. J. Perrott, who recently joined the research staff of the A. O. Smith Corp., Milwaukee, Wis.

Following the war, Mr. Yant was appointed instructor in chemistry at the college of Wooster, Wooster, Ohio. He joined the gas laboratory staff of the United States Bureau of Mines in 1920, and was assigned to problems relating to mine, industrial and fuel gases. In 1923 he was appointed chemist-in-charge of the bureau's gas laboratory, and in 1925 he became supervising chemist of the health laboratory section.

Few Office Buildings May be Built for Several Years

A survey made by the National Association of Building Owners and Managers recently completed showed that 14.69% of the office space in 41 of the principal cities is unrented. This indicates that the building activity of recent years has anticipated the needs of American business by providing a supply of space sufficient to take care of the normal expansion of business for several years.

The survey indicates that in 1935, office buildings, having a total of 165,611,811 sq. ft. of floor area, 24,321,615 sq. ft. are vacant. The association looks for no striking increase in office building construction for some years to come.

Three and a Half Billion for New 1931 Construction

New 1931 construction totaling more than $3,500,000,000 is already planned, actually under way, or about to be started in the United States, according to a nation-wide survey of the building situation just completed by Nelson, Hunt & Co., Chicago.

This figure, based upon data from government and private sources, as well as reports from building officials in leading cities, it was explained, does not include nearly a billion dollars worth of federal, state and county highway construction, which is of particular importance this year because of its large consumption of labor and building materials.

Reports from leading cities and industrial sections of the country indicate that construction activities as a whole are proceeding at near the same rate as in 1930. Up to February 15, heavy engineering and public work was leading in activity, being about 10% ahead of last year. Residential and small homes building also increased in some communities, particularly in the New York metropolitan area where an 18% gain in this type of construction was reported in January.

Public works, public buildings, state highways, municipal improvements and all types of federal and state work will undoubtedly be the most important factor in utilizing labor and building materials in 1931

Coming Events

April 13-18, 1931. American Oil Burner Association Convention at Philadelphia. Headquarters at the Benjamin Franklin Hotel.

April 18-25, 1931. Fourth Biennial Exposition of Architectural and Allied arts, Grand Central Palace, New York.

April 22-24, 1931. American Welding Society Annual Meeting in New York. Headquarters, 33 West 39th Street.

May 4-9, 1931. Thirteenth Exposition of Chemical Industries, Grand Central Palace, New York.

May 6-8, 1931. Spring Meeting of the American Society of Refrigerating Engineers at Kansas City, Mo. Headquarters at the Hotel President.

May 6-9, 1931. Annual Convention of Heating and Piping Contractors National Association at Louisville, Ky. Headquarters at the Kentucky Hotel.

May 11-14, 1931. Natural Gas Department Convention of the American Gas Association, to be held at Memphis, Tenn. Headquarters, Hotel Peabody.

May 21-22, 1931. Second Midwest Bituminous Coal Conference, at the University of Illinois, Urbana, Ill.

June 2-5, 1931. Annual Convention of the National District Heating Association in Boston. Headquarters at the Hotel Statler.

June 8-11, 1931. Annual Convention and Informashow of the National Association of Purchasing Agents in Toronto, Canada. Headquarters at the Royal York Hotel.

June 22-25, 1931. Forty-Ninth Annual Convention of the National Association of Master Plumbers, to be held in Milwaukee, Wis. Headquarters at the Milwaukee Auditorium.

June 23-26, 1931. Summer Meeting, American Society of Heating and Ventilating Engineers, at Swampscott, Mass.

July 13-17, 1931. National Association of Building Owners and Managers. Headquarters at the Olympic Hotel, Seattle, Wash.

November 30-December 5, 1931. First National Exposition of Mechanical Handling at the Grand Central Palace, New York.

Printing Experts Discuss Air Conditioning

Manufacturers of humidifying apparatus attended the second conference of the Technical Experts in the Printing Industry held in Harding Hall, Government Printing Office, Washington, March 16-17. The conference was sponsored by the Printing Industries Division of the A.S.M.E. with the Government Printing Office and the United Typothetae of America as joint hosts.

The principal paper on air conditioning was scheduled to be presented by Willis H. Carrier, as president of the A.S.H.V.E., but owing to his absence the paper was read by D. C. Lindsay. Papers describing manufacturers' equipment were read by the following: Marvin C. Barnum, The Wilcolator Company; Frederic F. Bahnson, The Bahnson Company; R. T. Williams, Carrier Engineering Corporation; R. H. Brown, Parks-Cramer Company.

Those attending, numbering over four hundred, were principally technical experts on printing. In addition to the papers, manufacturers exhibited equipment. Another feature of the program was a group discussion of air conditioning problems, participated in by those attending and by air conditioning manufacturers.

All of the manufacturers attending expressed their appreciation of the fine cooperation and assistance given them by A. E. Hanson, superintendent of maintenance and construction of the Government Printing Office, and his staff. Exhibit space and installation were furnished by the Government Printing Office without charge.

Dr. Walter M. Cross

Dr. Walter M. Cross, president of the Kansas City Testing Laboratory, died March 24. He was 53 years old. Doctor Cross was credited with the development of the most widely used processes for making gasoline from crude oil. He was known to many engineers through his book, "Handbook of Petroleum, Asphalt and Natural Gas."

New Apparatus and Appliances

Heavy Electrode for Pipe Welding

General Electric Co., announces a heavily coated welding electrode, designated as type R. It is composed of 0.13 to 0.18 carbon steel covered with a heavy coating of cotton braid impregnated with an arc stabilizing flux, and will be available in diameters from ⅛ in. to ⅜ in. in 18 in. lengths.

Metal deposits of this electrode will have high tensile strength and will produce a homogeneous structure resulting in a ductile weld. This is caused by the fact that, during the arc transference period, the metal is in a protective atmosphere because the electrode itself burns away quicker than the coating and excludes those elements always prevalent in atmosphere which cause some undesirable results when an uncoated rod is used.

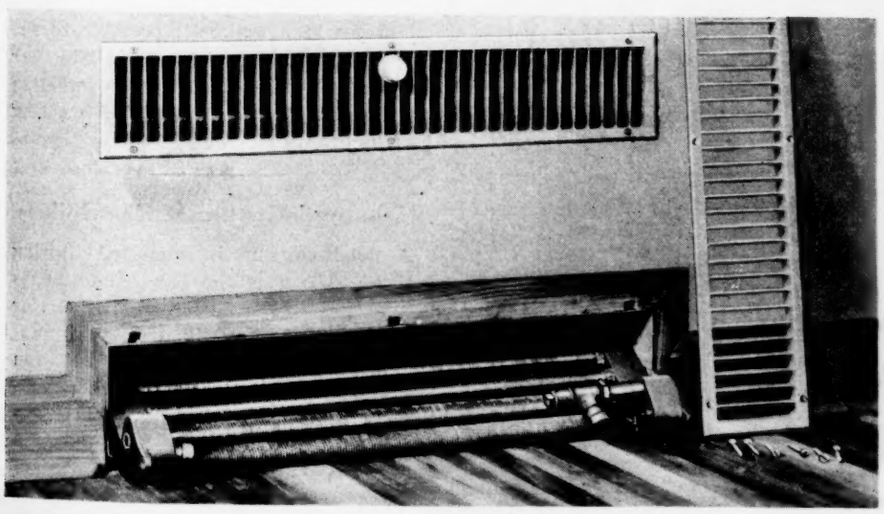
Type R Welding Electrode

Dunham Concealed Radiation

C. A. Dunham Co., Chicago, Ill., announces the recent development of a concealed radiator especially adapted for use with the Dunham Differential Vacuum system.

Seamless drawn copper tubes are used, connected to the headers by screwed ground joints, a standard method for securing a tight reliable joint which, the manufacturer states, has never before been used in concealed radiation. The connection is permanently steam tight, requires no gaskets or soldering, and makes each tube an independent, easily removed unit. The radiating fin is a smooth continuous spiral, with no dust-catching hollows and is metallically attached to the tube.

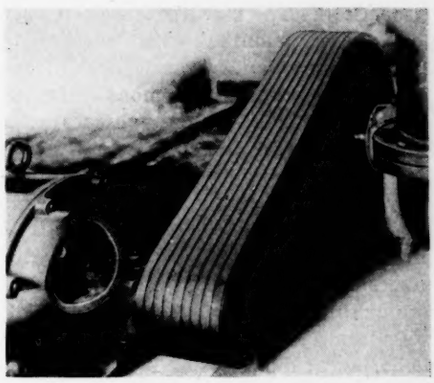
The radiator is so designed that it may be removed from the recess, if necessary, merely by disconnecting the steam pipes. This eliminates the former objection to concealed radiation, from a maintenance standpoint. The casing telescopes, providing an adjustable feature that saves a great deal of installation difficulty.



Dunham Concealed Radiator, Showing Method of Installation

Dayton Cog-Belt Drive

The Dayton Cog-Belt drive has been announced by the Dayton Rubber Mfg. Co., Dayton, O. The belt derives its name from the series of tooth-shaped corrugations on the inner surface of the compression section. The cogged surface is not for the transmission of power, but provides flexibility and prevents buckling when the belt is flexed around the pulley, causing it to hug rather than to resist the pulley arc, and at the same time present even surfaces to the sides of the groove.



Dayton Cog-Belt Drive

The cog runs crosswise, which the manufacturer claims gives great cross-sectional rigidity and prevents distortion. So made that it can elongate without undue internal strain, the outer portion of the belt consists of a series of convolute layers of a bias-cut fabric.

The neutral zone is the strength member which consists of a series of convolute layers of pre-stretched parallel cord cable fabric.

Boring Machine Avoids Tearing Up Pavements

A patented hydraulic auger, the Hydrauger, designed to reduce the tearing

New Apparatus and Appliances

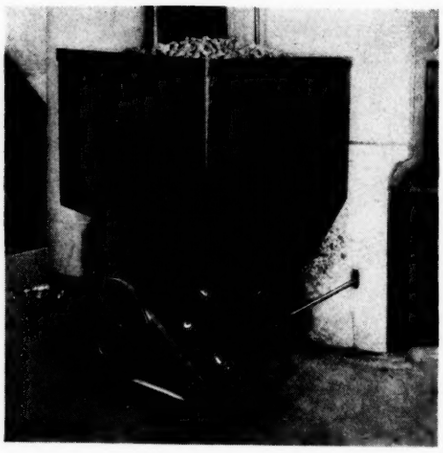
up of pavements for the placing of pipes, has been announced by the Hydrauger Corp., Ltd., 1298 Bryant St., San Francisco, Calif. The machine has been used for several months with success in Marin County and several parts of the San Francisco area, demonstrating it can bore under wide thoroughfares without necessity for trenching. The device has succeeded in overcoming the tendency to drill a gradually declining hole due to gravitation. An operator can direct its bore with precision at distances of 40 ft., bringing it out to within two or three inches of the point at which it is aimed. The machine is capable of boring at distances of 100 ft. or more without the necessity of trenching.

Stoker for Warm Air Furnaces

Announcement has been made by the Fire-King Stoker Co., Indianapolis, Ind., of the addition of an entirely new product, the Stokerette, to the company's line of automatic heating equipment.

The Stokerette is designed for use in warm-air furnaces and is considerably different in design and construction from conventional equipment of this nature. It is designed to burn pea coke, which can be obtained at a lower cost than regular size coke or furnace coal.

In the use of coke as a fuel, the Stokerette gives the user an advantage in cleanliness. The hopper containing the fuel supply holds 300 lb. of coke, which is sufficient to supply average winter fuel demand for three or more



Stokerette for Warm-Air Furnaces

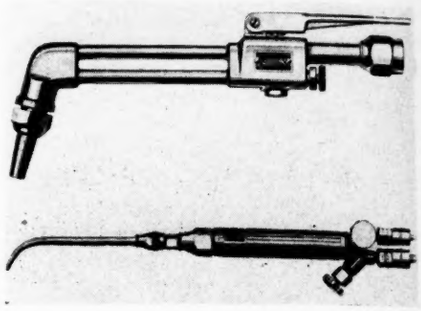
days. Special equipment is available whereby gravity feed direct from the fuel bin can be arranged to eliminate the necessity for filling the hopper.

Three separate controls, each independent of the others, are used to operate the Stokerette. A thermostat, installed in any room, can be set to a desired temperature. A time switch and a counter-weight control are the other two mechanisms which operate the stoker. The former regulates the length of time of operation, while the latter acts as a check to assure an adequate supply of fuel at all times.

Attachments for the Oxweld W-17 Welding Blowpipe

Oxweld Acetylene Co., 30 East 42nd St., New York, has recently introduced new accessories for the Type W-17 welding blowpipe which make this blowpipe capable of doing almost any type of work which may be required of an oxy-acetylene blowpipe.

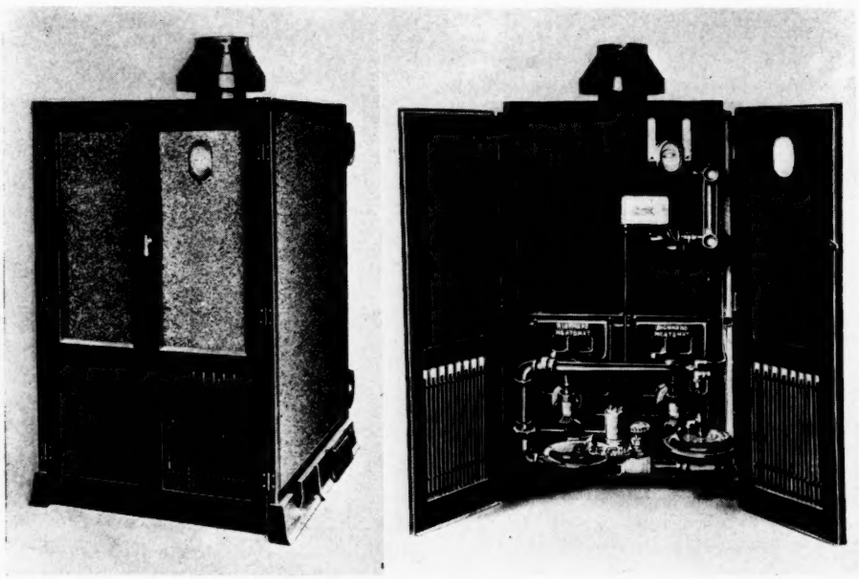
The Type CW-17 cutting attachment enables the blowpipe to do a reasonably wide range of cutting work. This cutting attachment differs radically from any such attachment which has previously been manufactured. It will be noted that a long handle is used for operating the cutting oxygen valve. When this handle is not in use, it can be pulled forward parallel to the tubes so that the whole attachment may be carried around in the operator's pocket. The attachment has the same style stem lock nut as the welding head for the Type W-17 blowpipe. The injector for the heating flames is contained in the attachment, just as the injectors are contained in the welding heads. At the rear of the attachment near the bottom is an adjusting screw, so that the oxygen for the heating flames may



Above—Oxweld CW-17 Cutting Attachment in Operating Position
Below—Oxweld W-17 Blowpipe Handle with Adaptor and W-15 Welding Head

be regulated by the operator's thumb and forefinger while the blowpipe is in operation. The attachment is joined to the blowpipe handle in exactly the same manner as a welding head, that is, the lock nut can be tightened by hand and no wrench is necessary to join the attachment to the handle. The attachment is supplied with two cutting nozzles.

Another accessory which has just been introduced for use with the W-17 welding blowpipe is the W-17 to W-15 adaptor which makes it possible to use any of the welding heads available for the Oxweld W-15 sheet metal welding blowpipe with the Type W-17 welding blowpipe handle.



Richmond Heatomat Boiler

Richmond Heatomat Gas Boilers

A de luxe line of gas-fired heating boilers, known as the Heatomat line, is being sold by the Richmond Radiator Co., Gas Products Div., 2220 Chestnut St., Philadelphia, Pa. The cast-iron sections are of vertical tubular construction in order to promote a rapid circulation. A water jacket surrounds the burner so as to absorb the maximum amount of heat from the products of combustion.

The steam boilers are equipped with

New Apparatus and Appliances

a low-water cut-off to shut off the gas when the water level falls too low, and a checkless steam condensate return prevents the water in the boiler from backing into the return lines.

The boilers are made in 24 sizes with steam ratings ranging from 225 to 6000 sq. ft. of radiation. The steam boilers are designated as model ST and the water boilers as WT.

Steam Boiler Control

Penn Electric Switch Co., Des Moines, Ia., has announced the Type J, Model QB boiler control designed to automatically regulate pumping equipment supplying make-up water necessary to maintain a constant water line in steam boilers. The device is said to be responsive to a ⅜ in. heat change in water level and automatically starts the pumping equipment when a predetermined low level is reached.

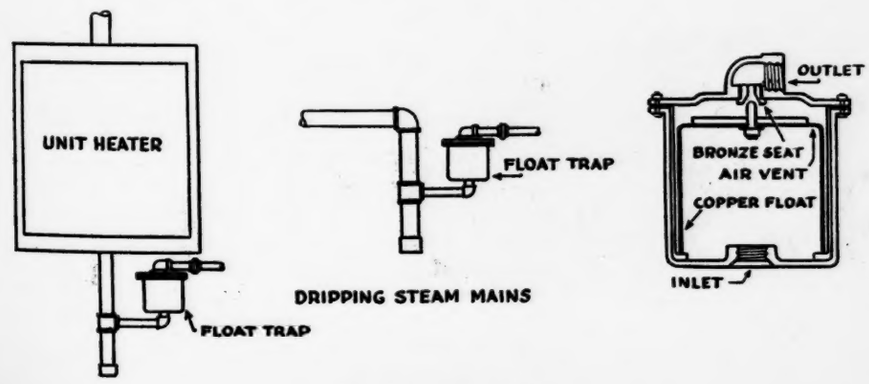
A spherical copper float actuates the switching mechanism through a flexible bellows. The bellows is so located that it comes in contact with distilled water only; so as to minimize the chance of accumulating scale and corrosion.

The housing surrounding the float mechanism is made of cast iron. By means of a differential adjuster in the switching mechanism, the water level control can be set to regulate the level at a minimum of ⅜ in. or a maximum of ¾ in.

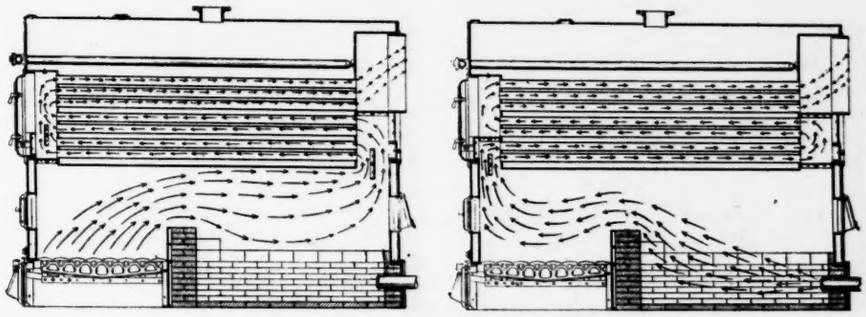
Stay-Rite Float Trap

A float trap designed especially for dripping steam mains and unit heaters, has been placed on the market by the Stay-Rite Co., Inc., 1250 West Fourth St., Cleveland, O. The trap will handle both air and water without the use of thermostats or by-passes.

The trap is said to keep dirt in suspension so that it cannot rest on the valve seat, due to the design in which the valve is placed on the top of the trap. In operation steam lifts the float and closes the valve. When water accumulates in the trap the float will drop, permitting water and air discharge. The trap is made in ½ in. and ¾ in. sizes with capacities of 200 lb. and 500 lb. respectively.



Stay-Rite Float Trap



(Left) Combination Boiler as Used with Coal
(Right) as Used with Oil or Gas

Oil, Gas or Coal Boilers

Combination Boiler Co., Benton Harbor, Mich., has placed on the market a boiler which can be used either for bituminous coal, gas or oil.

When coal is fired, the gas is passed through a combustion chamber at the rear of the boiler and then, by means of two passes, to the stack. Oil or gas is fired from the rear (in what constitutes a combustion chamber when the boiler is used for coal) and the gases make three passes before entering the stack.

Baffles for changing the course of the flue gases are controlled by levers on the side of the boiler.

Boilers are available in 27 sizes with ratings from 650 to 32,080 sq. ft. of steam radiation.

Glass Wool for Heat Insulation

According to an announcement from Arthur D. Little, Inc., a new insulating material, glass wool, has been developed abroad. This material should not be confused with mineral or rock wool; the fibres are very long and of uniform small diameter. The material is made from refuse glass and the resulting product is a beautiful, silky, white material which undoubtedly has a high insulating value.

Much study has also been given to the use of aluminum foil as heat insulation. Aluminum is a good conducting metal but the bright surface of aluminum will radiate only one-tenth to one-twentieth as much heat as common insulating materials. If several layers of this foil are separated by small air spaces the transfer of heat is small, because the radiation is almost negligible and still air has approximately twice the insulating value of cork at room temperatures.

The foil can be used in smooth sheets separated with suitable spacers, or some sort of a pattern may be stamped on the sheets so that they only touch each other at a few points, leaving many small air spaces. Laboratory tests have been made on this type of insulation and they indicate that the insulating value is roughly the same as cork-board, while the material is considerably lighter per cubic foot of insulation. It has been stated that some of this material has been made so that it weighs but 3 oz. per cu. ft., which would make it of great value wherever weight was an important factor. An American manufacturer has very recently utilized aluminum foil by placing sheets of foil alternately with sheets of asbestos paper, thus gaining insulating value due to the low radiating power of aluminum, and also obtaining proper spacing of the foil.

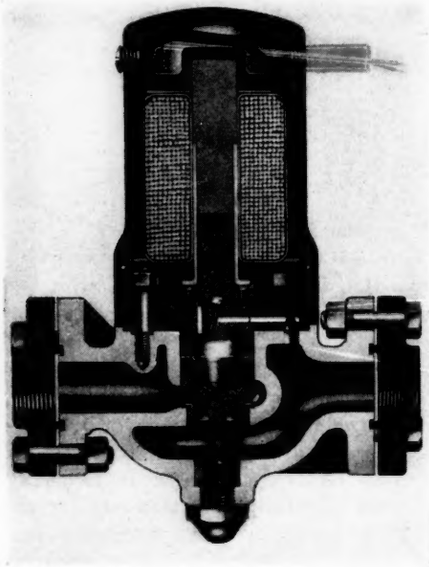
Carraway Valve for Remote and Automatic Control

An electrically controlled packless solenoid valve for remote and automatic control has been announced under the name Carraway by the Schwitzer-Cummins Co., Indianapolis, Ind. It is designed for the maintenance and regulation of temperatures, pressures, and for periodical applications. For use in fluid and gas lines with pressures up to

New Apparatus and Appliances

250 lb. Current consumption is 30 watts, permitting the use of electrical regulating devices without the addition of relays.

The valve can be used with refrigerat-



Section of Carraway Valve

ing systems in which a unit cooler similar to the conventional unit heater is the evaporator. The defrosting can be accomplished periodically by an electric time clock operating in connection with the valve. The valve is made in two models, No. 500 being from ¾ in. to 1¼ in.; No. 600, 1½ in. and 2 in. Both models are of the flanged type. Flanges are tongued into grooves in body flanges, seated on lead gaskets.

Autovent Furnace Blower

A line of furnace blowers has been announced by the Autovent Fan & Blower Co., 1805 No. Kostner Av., Chicago, Ill. The blowers are designed so that cold air can be admitted either through the top of the blower, through the rear, or in the case of pit jobs, from the bottom. The standard arrangement is that in which the cold air is admitted through the top.

The blowers are equipped with the Autovent Uniblade type wheel. Three-speed operation is accomplished by means of step sheaves on the blowers and motors. These sheaves have three-step arrangement so that by changing the V-belt drive from one groove to another the air deliveries can be changed.

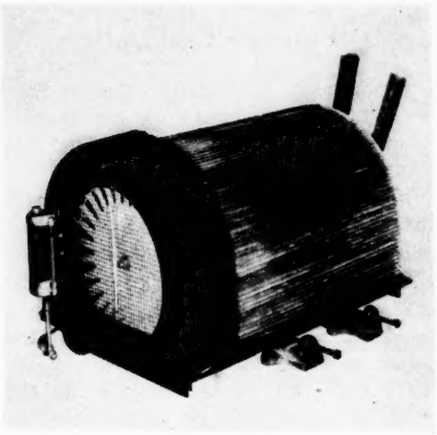
The blowers embody a recirculating damper arrangement by means of which approximately one third greater free area for gravity operation can be obtained when the furnace system is operating as a gravity system.

Available in six sizes, the blowers are designed for furnace ratings with capacities ranging from 500 to 1,800 sq. in. of leader pipe, calculated according to the Standard Code.

Enclosure for Open Frame Type Electric Motors

Daun-Walter Co., Milwaukee, Wis., announces a new electric motor enclosure for use on any open frame type motor to prevent the accumulation of dust, dirt and moisture on the motor.

As shown in the illustration, the enclosure consists essentially of a specially designed corrugated copper cover over the motor with steel end walls and supporting base plate. At one end of the enclosure a cooling fan and an



Corrugated Copper Cover for Electric Motor

outside combination guard and air deflector is provided. The cooling fan is mounted on the end of the motor shaft opposite the pulley end by means of a special shaft adaptor. The adaptor can be installed in a few minutes without disturbing the motor. By means of the fan and the air deflector a single path of outside air discharges over the outside areas of the patented deep-fin corrugated copper construction over the motor, thereby carrying off the heat from the interior developed by the motor. The base plate is of heavy gauge steel of box construction in which the motor sets and prevents the entrance of dirt, dust or moisture from below. The complete enclosure is so designed as to permit mounting on slide rails for belt adjustment.

The enclosures are available for all open frame type motors, 2 and 3 phase, in sizes from 5 to 100 hp., and for d.c. motors from 5 to 100 hp.

Cleveland Stoker

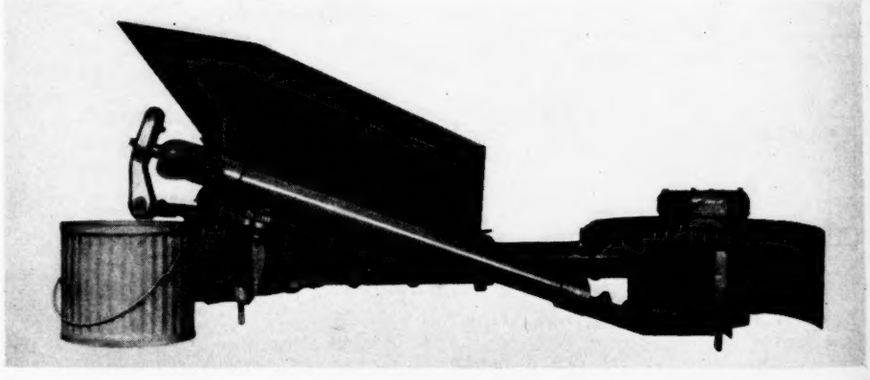
The perfecting and producing of an automatic domestic soft coal stoker, which not only feeds coal into the furnace but shakes the grates and removes the ashes, is announced by The Cleveland Stoker Co., 6545 Carnegie Ave., Cleveland, O.

By means of an intermittent mechanism the stoker feeds a regulated amount of slack coal from a hopper into the burner where the coal is held while it is ignited and coked under forced air draft, the coke working on to automatically shaken grates where it is burned under forced draft.

The stoker is controlled by an adjustable electric clock and thermostat. The intermittent coal feed can be set by turning a screw to feed from one-half pound to seven pounds per cycle. If the feed is set at one-half pound and the clock at one cycle, the stoker will burn one pound of coal per hour. At this setting it will burn ten pounds of coal per hour if the thermostat calls for heat.

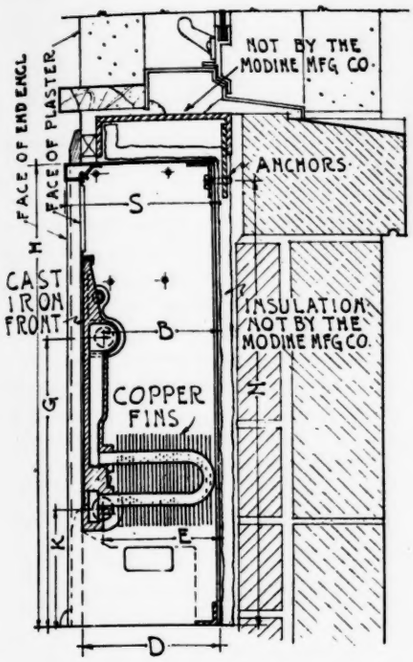
The stoker can be installed in an existing furnace and put into operation in about three hours. The present model has a capacity of 1500 ft. of steam radiation. The company plans to build a smaller unit for all small homes and a large unit about twice the capacity of the present one.

The Cleveland Stoker is proving of particular interest to Ohio coal operators because it burns slack of all Ohio coals. It also burns Pocahontas slack.



Cleveland Stoker

New Apparatus and Appliances

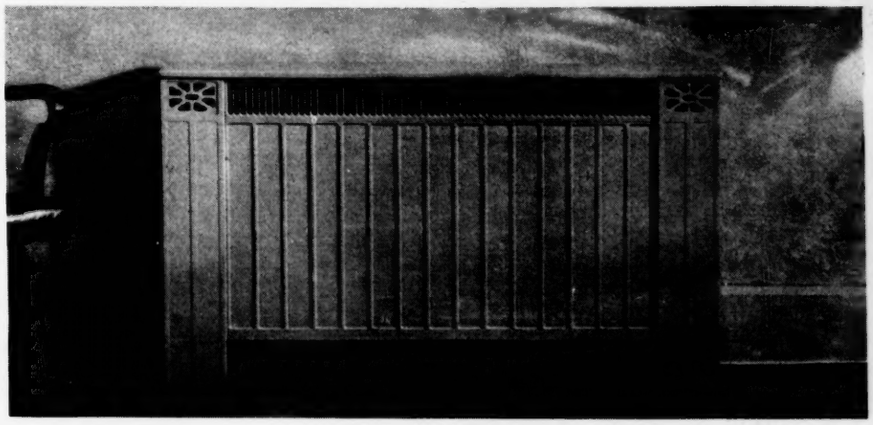


Section Through Fully-Recessed Copper-Cast Radiator

Modine Copper-Cast Radiator

A radiator which is a combination of cast iron and copper, has been announced by the Modine Manufacturing Co., Racine, Wis. The front is of cast iron with integral steam-carrying tubes to provide radiant heat. A copper tube and fin assembly is joined to the cast iron front, the whole encased in a sheet steel housing. The convected heat is delivered out into the room through a vertical grille.

The manufacturer states that only 30% of the total heat is in the form of radiant energy, while 70% is convected heat. All parts of the radiator are accessible since the whole heating element can be taken out as a unit from the casing by removing two retaining stud bolts on either end of the radiator. The radiator weighs only one-third as much as a cast iron radiator.



Modine Copper-Cast Radiator

No trade jurisdiction disputes need accompany the installation inasmuch as the product is supplied complete, ready to mount on or in the wall.

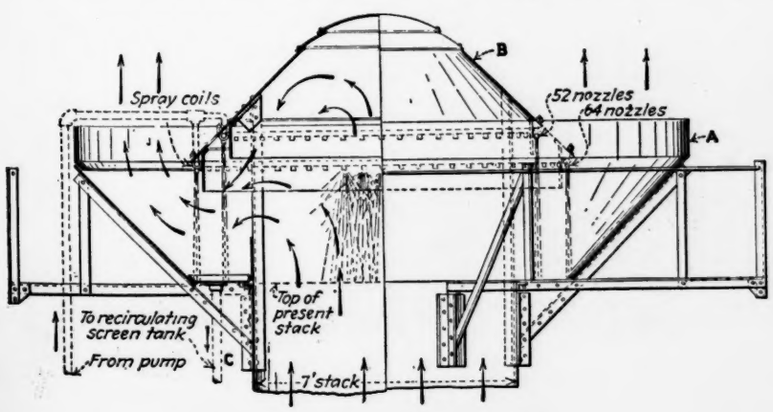
The unit is customarily suspended on the wall with the aid of expansion bolts, the rigid back sheet of the casing lending support by reason of its resting on the floor. The radiator without modification may be partially or entirely recessed in the wall. The unit is available for both steam and water systems in capacities ranging from 8 to 61 sq. ft. of radiation.

Washers to Remove Ash, Soot and Fumes from Boiler Gases

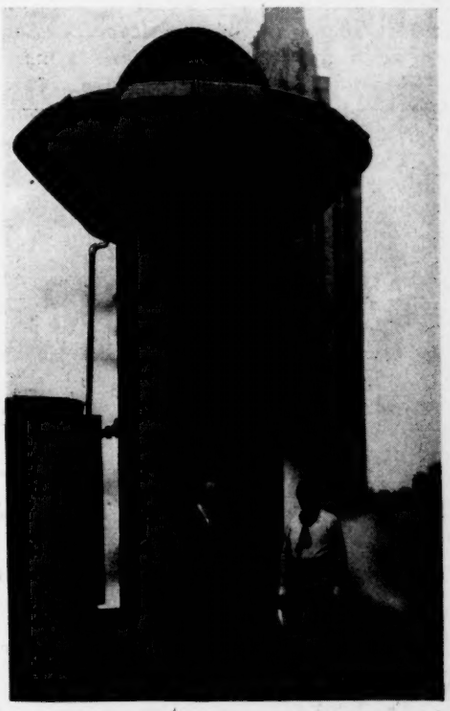
In order to prevent the discharge of fly ash from coal-fired plants, soot from oil-fired installations, as well as sulphurous fumes common to both, a down-jet, spray-type washer for installation on boiler stacks has been brought out by the American Smoke & Soot Washer Co., Inc., 55 West 42 St., New York.

An inverted cone A, is fastened to the top of the stack with a dome-shaped canopy B, slightly larger in diameter than the stack, supported centrally above it. Two spray coils are attached on the inner side and near the lower edge of the canopy B. Each coil is fitted with flat spray-type nozzles so as to produce a thin, circular curtain of water completely surrounding the stack. Thus the flue gases must pass through two curtains of water. To prevent any gas escaping between the nozzles or above the curtain, circular baffles are placed directly inside the spray coils.

A motor-driven centrifugal pump is used to maintain the 20 to 30 lb. pressure required in the spray coils. The drain from the spray, as at C, is led to a recirculating screen tank, where, by means of screens and baffles the solid particles are precipitated and the water is recirculated through the nozzles by the pump. The only labor that is involved is the removal of the solids from the tank at intervals and the cleaning of the screens occasionally. The washer is equally well adapted to brick as to steel stacks.



Section of Smoke and Soot Washer



Soot Washer on Ritz-Carlton Hotel, New York

New Apparatus and Appliances

Sturtevant Filticooler

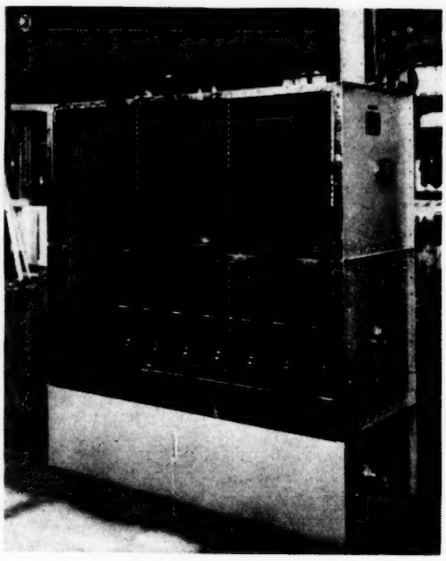
Occupying about half the space required for the standard type of air washer of the same capacity, the Filticooler, announced by the B. F. Sturtevant Co., Hyde Park, Boston, Mass., is designed to filter, wash, cool and humidify the air passing through it.

It is made in 15 sizes, and is available in units of one, two or three sections, as required, each section being 29 in. high and 28 in. deep in direction of air flow. Widths vary from 20½ in. for No. 1 size to 10 ft. 8½ in. for No. 10. Each unit consists, essentially, of two eliminators, two air filters, and a set of spray nozzles. The air filters are continually flushed by water, which prevents their clogging up and reducing the air flow. To permit of placing the air fan close up to form a compact unit the eliminators are divided in the middle and face both ways.

Douglass Pipe Fitting Machine

Douglass Bros. Co., 352 Whiting St., Chicago, Ill., has announced a machine which automatically prepares pipe of 4 in. to 18 in. diameter of any wall thickness, for fabrication into welded tees, miter elbows and bull plugs and also bevels plain end pipe for butt welds.

The machine cuts and bevels at the same operation. The bevels conform to the standards of the American Gas Association and the Heating and Piping Contractors National Association. The cuts are smooth and clean, free from oxide and scale and require no further preparation for welding.



Sturtevant Filticooler

Heat is localized so that there is no warping or distortion of the pipe. Templates or patterns are not required as the required template is generated in the machine by making two simple adjustments. It is claimed that a perfect cut can be made in less time than it takes to lay out the work for hand cutting.

Meier Nu-air Fans

A full line of ventilating fans is being manufactured by the Meier Electric and Machine Co., Indianapolis, Ind. The line includes a wall box kitchen ventilator made of metal which comes complete with an automatic shutter. The company also makes a ventilator which is adjustable and for installation in windows.

The line of portable coolers is made entirely of aluminum with an adjustable fan head, and can be used either for cooling or accelerating drying processes.

A line of small propeller type fans is available in 10, 12, 16, 18, 24, 27, 30, and 36-in. sizes with three or five blades, built entirely of aluminum and with capacities ranging from 375 to 20,500 cu. ft. of free air.

Armstrong Cooling Cutting Oil

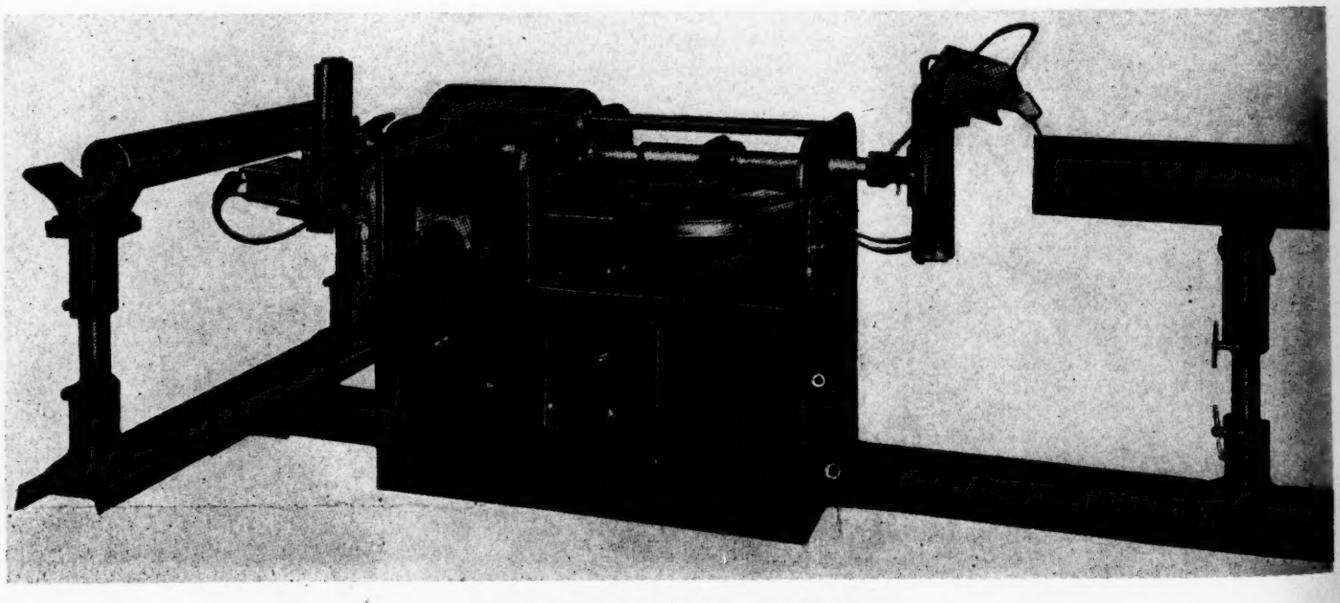
A cutting oil which has the property of cooling to a marked extent, has been announced by the Armstrong Mfg. Co., Bridgeport, Conn. The manufacturer states that the two essentials of cutting oil are viscosity and absorption of heat. The two oils which give best results are lard oil and sulphur base oil. The former is more expensive than the latter and does not equal it in performance. The new oil is said to be superior to either of the two, due to its viscosity and heat absorption.

American-Marsh Type QR Centrifugal Pump and Receiver

The American Steam Pump Co., Battle Creek, Mich., has announced the American-Marsh Type QR pump and receiver which will carry returns from radiation heating coils, etc., and return the condensation of the boiler in its hottest state.

The pump is equipped with an unusual impeller, consisting of a hub, suction eye and a single hollow vane of stream line design. It is claimed that the disc friction has been reduced to a minimum. The impeller hub, suction eye and the pump shaft are cast in one piece with the impeller vane.

The unit is made in two sizes, with capacities up to 25,000 sq. ft. of radiation.



Machine for Cutting Pipe for Welding

"We have every confidence in Powers Temperature Control and would certainly install it in future mills which we build, it being the best regulation of its kind on the market."

First-Cost of Powers Control Is Often Higher

4 reasons why it costs less in the end

◀1▶ It often gives 15 to 20 years of Accurate and Dependable control without repairs of any kind.

◀2▶ Greater Steam Economy due to the fact that thermostats do not get out of adjustment and permit overheating.

◀3▶ Graduated Control, because of its greater accuracy, provides maximum comforts for occupants of rooms.

◀4▶ A minimum of service calls and the trouble and annoyance connected with them.

THE POWERS REGULATOR COMPANY

40 years of specialization in automatic heat control

2720 Greenview Ave., CHICAGO
231 E. 46th Street, NEW YORK

Offices in 37 other cities

TORONTO—106 Lombard St.

CABLE ADDRESS, "THREADERS, PATERSON"

The Linen Thread Company
Mechanical Department
GRAND ST. *Paterson, N.J.*

Powers Regulator Co.,
2720 Greenview Ave.,
Chicago, Ill.

Gentlemen:-

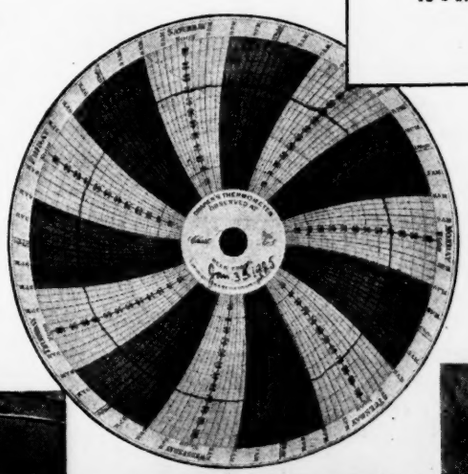
Some two years ago we investigated the different systems of heat control with a view to installing such systems in two of our mills. Would say that since that time installations have been made in the Finishing Department and Office at our Grand St. mill and in the entire new Jute Mill at Kearny, N.J.

We have kept accurate temperature records of heat in these rooms at various times and would say that the results accomplished by your control are certainly remarkable, particularly in our Jute Mill at Kearny where we need to control the temperature within very close limits on account of certain manufacturing processes. We do not believe we could have run this mill at all satisfactorily unless we had a control such as yours.

We have every confidence in Powers Temperature Control and would certainly install it in future mills which we build, it being the best regulation of its kind on the market.

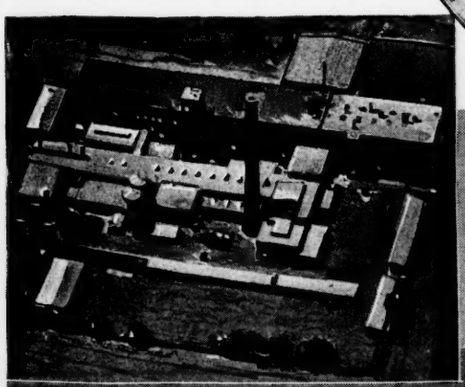
Very truly yours,
THE LINEN THREAD COMPANY

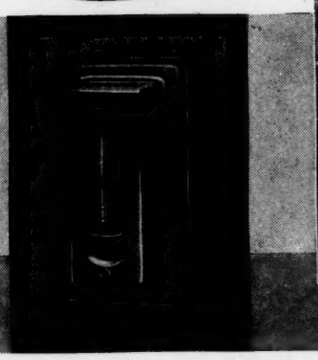
PS - WVH



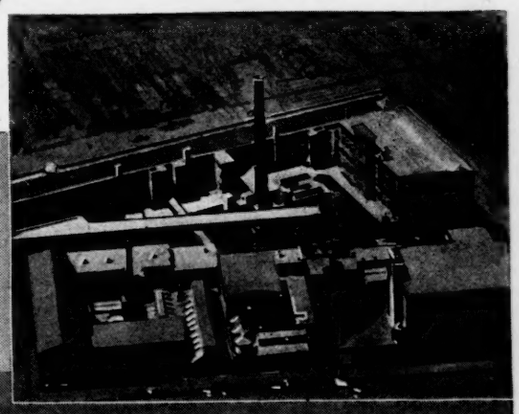
Temperature Chart shows the accurate control obtained with POWERS Regulation at the Linen Thread Company

Jute Mill of the Linen Thread Co., at Kearny, N. J.





Grand Street Mill of the Linen Thead Co. at Paterson, N. J.



POWERS

With the Manufacturers

Silent Automatic Conducts Training School

Realizing that a trained oil burner man is essential to the success of each dealer's organization, the Silent Automatic Corp., Detroit, Mich., conducts in its plant a school that gives a six-day course which embraces practically everything ranging from theory of combustion to installation and service work in the field. Directing this educational enterprise is J. A. Harris, a graduate chemical engineer from the Rensselaer Polytechnic Institute, with years of experience in the industrial field. The school occupies half of the sixth floor of the plant at Detroit.

Newport Boilers Acquired by Richardson and Boynton

Announcement has been made by Newport Boiler Co., Chicago, that Richardson and Boynton Co., New York, has acquired all Newport patents, patterns, equipment, etc. R. R. Owen, formerly in charge of New York sales for Newport, will be in charge of sales of Newport boilers for Richardson and Boynton. The Newport Boiler Company will retain its charter under the state of Illinois for perhaps another year.

Jas. P. Marsh & Co., Chicago, announces the appointment of the American Appliance Co., 1214 Harney St., Omaha, Neb., and the Ludwig-Austen Co., 625A West Second St., Oklahoma City, Okla., as district sales representatives in their respective territories.

The H. B. Smith Co., Westfield, Mass., announces the election of Grant Pierce, formerly president of the National Radiator Company, as vice-president and member of the board of directors and executive committee of its company. Mr. Pierce will act as sales manager in addition to his general duties with the company.

Institute of Boiler and Radiator Manufacturers reelected H. T. Richardson, of Richardson & Boynton Co., New York, as chairman of that organization, at a meeting held recently in New York. E. E. McNair, of the United States Radiator Corp., Detroit, was reelected vice-chairman, and F. W. Herendeen, Geneva, N. Y., continues as secretary-treasurer.

Ames Pump Co., Inc., Division of American Locomotive Co., 30 Church St., New York, announces the election of William C. Dickerman as chairman of the board, and David T. Williams as a director and president of the company. John D. Finn was appointed secretary.

Laboratory of Silent Automatic Training School

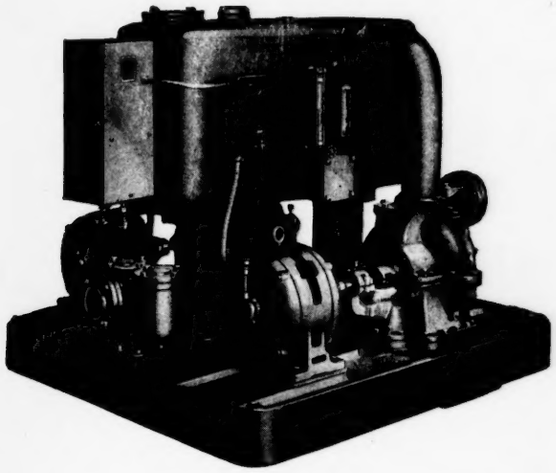
M. G. Harbula, consulting air conditioning engineer, announces the removal of his Chicago offices to 693 Glen Ellyn, Ill.

International Heater Co., Utica, N. Y., announces that Irving L. Jones, formerly treasurer, has been elected president succeeding Frank E. Wheeler, deceased. Robert L. Griffiths, formerly credit manager, succeeds Mr. Jones as treasurer, and Mary J. Beggs, assistant treasurer, has been appointed comptroller. Harry A. Chester, purchasing agent, succeeds Miss Beggs as assistant secretary and treasurer.

Penn Electric Switch Co., Des Moines, Ia., announces the opening of a sales office in the General Motors Building, Room 11-237, Detroit, Mich. Paul O. Penn is manager of this office.

Carrier Corp., Newark, N. J., announces the officers of its company and subsidiary companies as follows: Willis H. Carrier, chairman of the board of Carrier Corporation and Carrier Engineering Corporation; J. I. Lyle, president, Carrier Corporation and treasurer of Carrier Engineering Corporation, Carrier-York Corporation, and Brunswick-Kroeschell Company; Thornton Lewis, executive vice-president, Carrier Corporation, and vice-president of Carrier Engineering Corporation, Carrier-York Corporation, and Brunswick-Kroeschell Company; Sidney B. Carpender, vice-president of Carrier Corporation and first vice-president of Brunswick-Kroeschell Company; E. T. Murphy, vice-president in charge of sales, Carrier Corporation, and president of Carrier Engineering Corporation; R. A. Kroeschell, director of Brunswick-Kroeschell Company, and associate manager of theater division, Carrier Engineering Corporation; H. P. Gant, vice-president of Carrier Corporation and president of Carrier-York, Corporation; A. H. Goelz, assistant treasurer of Carrier Corporation and second vice-president of Brunswick-Kroeschell Company.

American Radiator & Standard Sanitary Corp., 40 West 40th St., New York, announces its affiliation with the Cochran-Sargent Co., wholesale distributors of heating and plumbing equipment, St. Paul, Minn. The latter company will be continued under its present name as a division of the American Radiator & Standard Sanitary Corporation, without change in either personnel or policy.



Facts

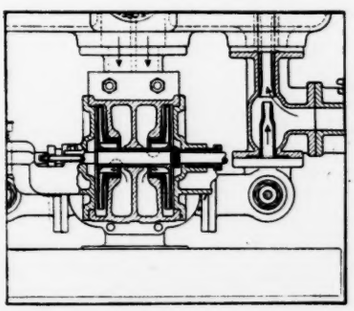
TEMPERATURE NO DETERRENT

TO CAPABILITY OF THE AMES PUMP

THE heating system, it must be assumed, should be reasonably tight. With the AMES PUMP a vacuum of 20" to 28" (referred to 30" Barometer) can be reached with condensate at a corresponding temperature.

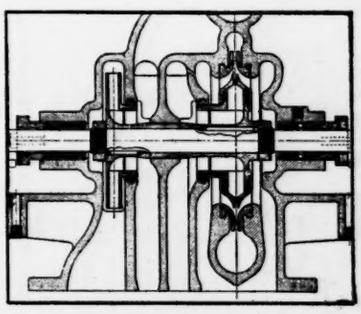
Since the effective work is done on the outside of a stationary or rotating vacuum producing element (See cut below), Temperature Is No Deterrent to the capability of the pump discharging all condensate to the boiler without waste—even at 209°F.

This advertisement is the third of the series. Nine more will follow.



stationary

Vacuum producing elements



rotating

Write for Bulletin No. 522 and 532

AMES PUMP COMPANY, Inc.

30 Church Street New York City

DIVISION OF

AMERICAN LOCOMOTIVE COMPANY

Degree Days and Unit Fuel Consumption in Typical Cities for February

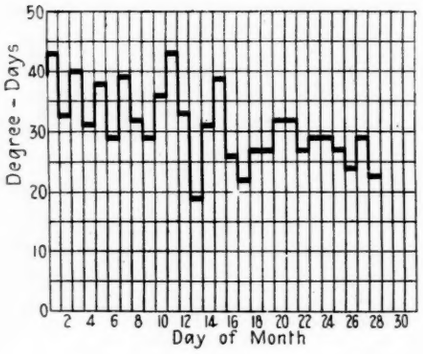
UNIT fuel consumption figures given below must be corrected for efficiency, heat content of fuel other than that listed below, for radiation emitting other than 240 B.t.u. per hr., and for radiation calculated on a basis of other than zero to 70°.

Coal is assumed as having a heat content of 12,000 B.t.u. per lb., gas, 1000 B.t.u. per cu. ft. and oil 140,000 B.t.u. per gal. To correct for other heating values, multiply the fuel consumption listed under the charts by the standard heat content just listed, and divide by the heat content of the fuel actually being used in the installation being calculated.

To correct for efficiency, divide the fuel consumption by the efficiency of the heating installation.

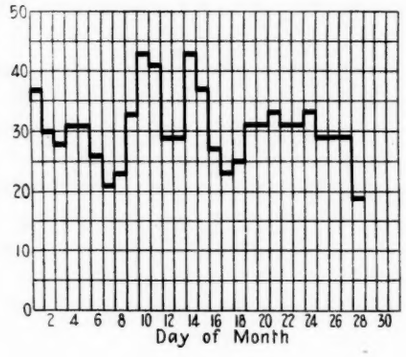
For water radiation, multiply the fuel consumption, which is given for steam radiation, by 5/8.

For radiation installed for any other outside temperatures than zero, multiply the fuel consumption given under the charts by 70°, divided by the quantity (70 minus the outside temperature used).



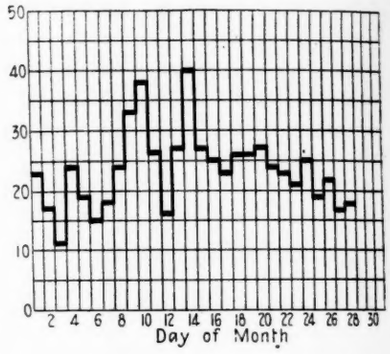
New York, February, 1931

Degree Days 869—to Date, 3685
Lb. of Coal per Sq. Ft. of Radiation for this Month, 6.952
Gal. of Oil per Sq. Ft. of Radiation for this Month, 0.596
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 83.42
(See Footnote)



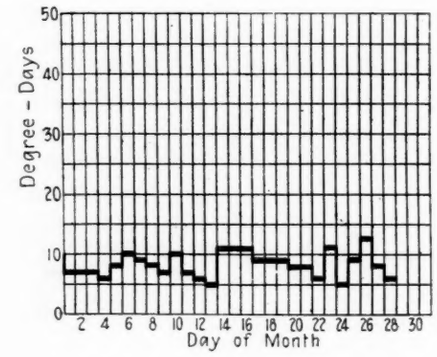
Pittsburgh, February, 1931

Degree Days 853—to Date, 3974
Lb. of Coal per Sq. Ft. of Radiation for this Month, 6.824
Gal. of Oil per Sq. Ft. of Radiation for this Month, 0.585
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 81.89
(See Footnote)



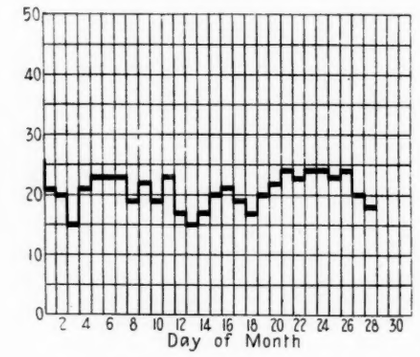
St. Louis, February, 1931

Degree Days 653—to Date, 3232
Lb. of Coal per Sq. Ft. of Radiation for this Month, 5.224
Gal. of Oil per Sq. Ft. of Radiation for this Month, 0.447
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 62.69
(See Footnote)



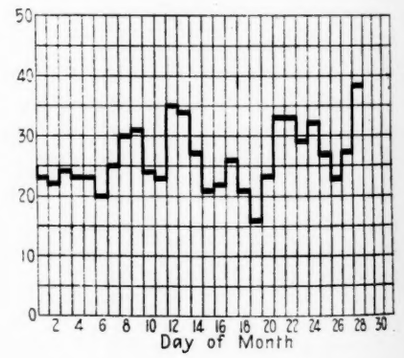
San Francisco, February, 1931

Degree Days 231—to Date, 1425
Lb. of Coal per Sq. Ft. of Radiation for this Month, 1.848
Gal. of Oil per Sq. Ft. of Radiation for this Month, 0.158
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 22.18
(See Footnote)



Seattle, February, 1931

Degree Days 577—to Date, 3063
Lb. of Coal per Sq. Ft. of Radiation for this Month, 4.616
Gal. of Oil per Sq. Ft. of Radiation for this Month, 0.396
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 55.39
(See Footnote)



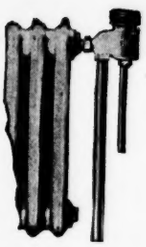
Denver, February, 1931

Degree Days 735—to Date, 3941
Lb. of Coal per Sq. Ft. of Radiation for this Month, 5.880
Gal. of Oil per Sq. Ft. of Radiation for this Month, 0.504
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 70.56
(See Footnote)

Fuel consumption figures must be corrected for local conditions as explained above.

(*Continued on Page* 122)

What is MINNEAPOLIS-HONEYWELL Engineered HEAT CONTROL?



The Modustat, Automatic Control Valve for Individual Radiators

Clock Thermostat

Motorized Valve for Steam Flow Control

Answer:

It is an individual application of automatic control engineered especially to fit your existing or proposed heating plant, whatever its size, type and fuel. It includes dependable, accurate regulators chosen from a complete line of automatic control equipment.

Why it is Needed

Because your heating control problem isn't exactly like any other.

What it Does

It establishes and holds individual temperatures desired in each building or part of your building—through control of your boilers and through individual, group or zone control of your unit heaters, pipe coils or radiators.

How it Benefits

Your fuel costs drop, not part way, but all the way to rock bottom. Uniform comfort and highest working efficiency are assured. Supervisory labor is reduced to a minimum.

How it is Obtained

Through co-operation of the Minneapolis-Honeywell engineer, who, backed by the largest organization of its kind in the world, helps your staff to select and apply the *one* control system exactly suited to your needs.

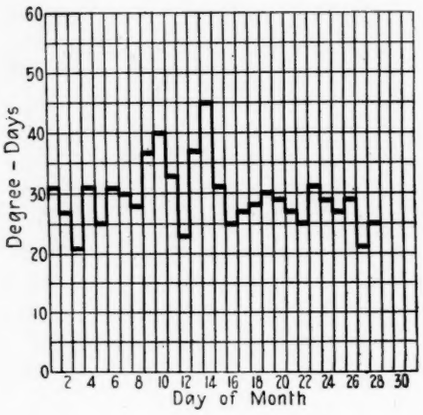
MINNEAPOLIS-HONEYWELL REGULATOR COMPANY
2715 Fourth Ave. So., Minneapolis, Minn.
In Canada: Minneapolis-Honeywell Regulator Co., Ltd., Toronto.
Branch Offices: New York, Philadelphia, Boston, Providence, Detroit, Cleveland, Chicago, St. Louis, Indianapolis, Milwaukee, San Francisco, Syracuse, Rochester.
Distributors in all principal cities

MINNEAPOLIS
INDUSTRIAL REGULATORS
HONEYWELL

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY
2715 Fourth Ave. So., Minneapolis, Minn.
☐ Send me pamphlet on Unit Heater and Sectional Control Systems.
☐ Have representative call. I understand there is no obligation.
Name..... *Position*.....
Company.....
Address.....
City..... *State*.....

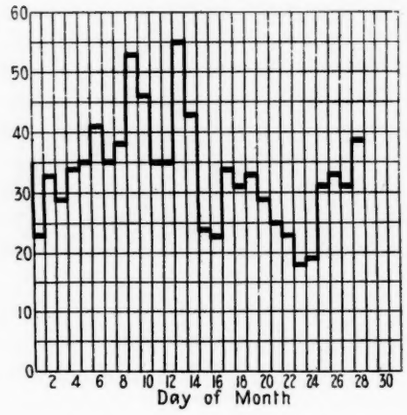
Degree Days for February, 1931

(*Continued from Page* 120)



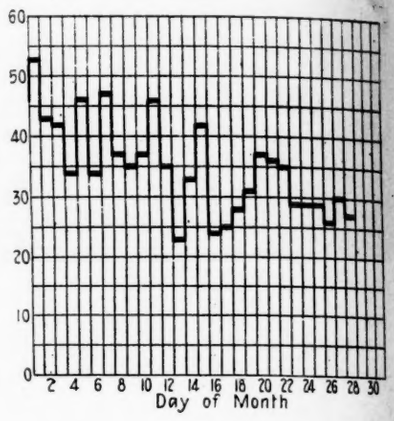
Chicago, February, 1931

Degree Days 823—to Date, 4129
Lb. of Coal per Sq. Ft. of Radiation for this Month, 6.584
Gal. of Oil per Sq. Ft. of Radiation for this Month, 0.565
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 89.01
(See Footnote, page 120)



Minneapolis, February, 1931

Degree Days 927—to Date, 4982
Lb. of Coal per Sq. Ft. of Radiation for this Month, 7.416
Gal. of Oil per Sq. Ft. of Radiation for this Month, 0.636
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 88.99
(See Footnote, page 120)



Boston, February, 1931

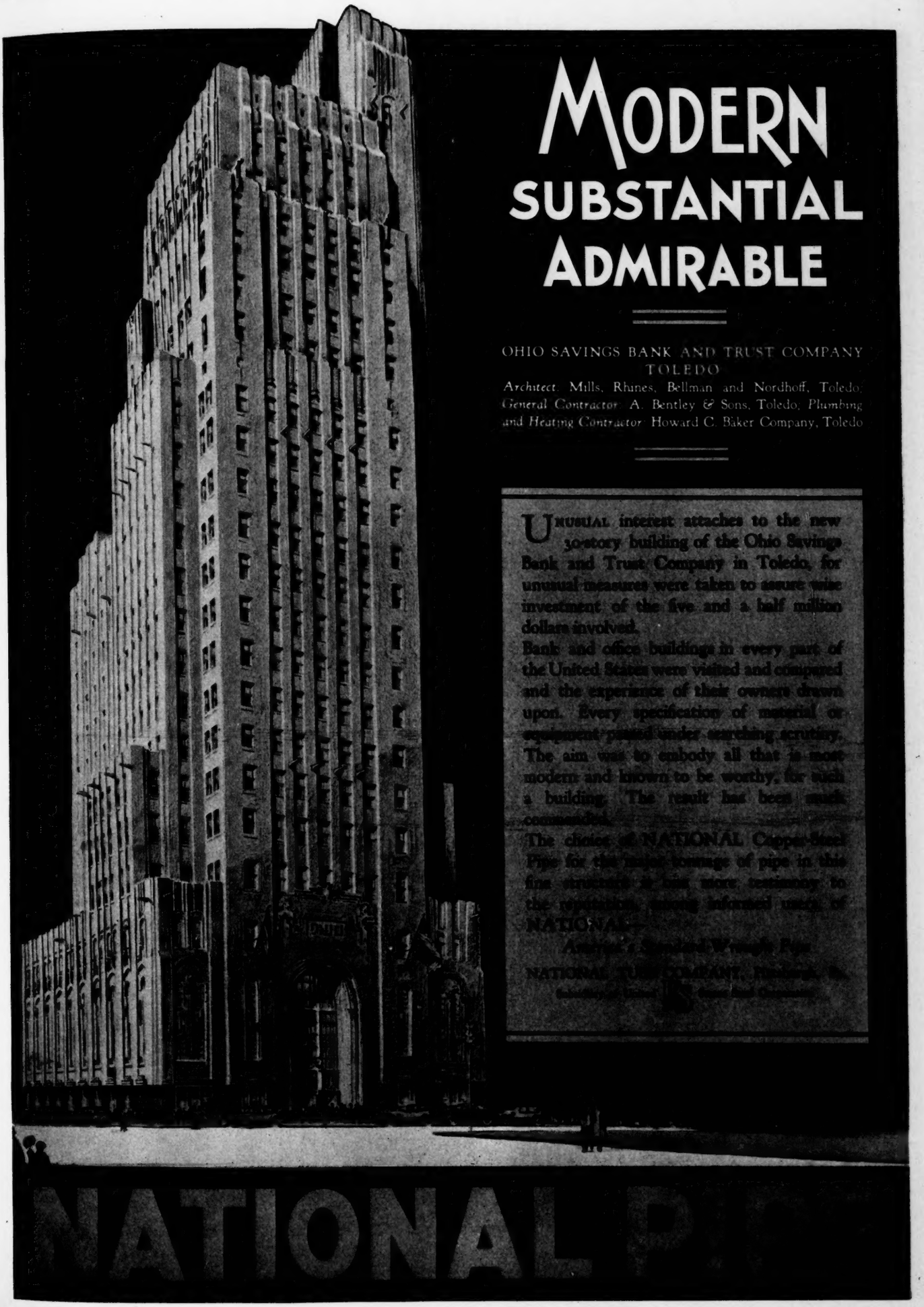
Degree Days 968—to Date, 4010
Lb. of Coal per Sq. Ft. of Radiation for this Month, 7.744
Gal. of Oil per Sq. Ft. of Radiation for this Month, 0.664
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 92.93
(See Footnote, page 120)

	Los Angeles	Baltimore	Philadelphia	New Orleans	Atlanta	Cleveland	Cincinnati	Detroit
Degree Days	122	713	774	170	489	897	734	898
Degree Days to Date	566	3202	3341	1145	2607	4017	3657	4349
Lb. of Coal per Sq. Ft. of Radiation for February, 1931	0.976	5.704	6.192	1.360	3.912	7.176	5.872	7.184
Gal. of Oil per Sq. Ft. of Radiation for February, 1931	0.084	0.489	0.531	0.117	0.335	0.615	0.503	0.616
Cu. Ft. of Gas per Sq. Ft. of Radiation for February, 1931	11.71	68.45	74.30	16.32	46.94	86.11	70.46	86.21

(See Footnote, page 120)

	Buffalo	Birmingham	Indianapolis	Memphis	Des Moines	Kansas City
Degree Days	1060	427	759	469	788	640
Lb. of Coal per Sq. Ft. of Radiation for February, 1931	8.480	3.416	6.072	3.752	6.304	5.120
Gal. of Oil per Sq. Ft. of Radiation for February, 1931	0.727	0.293	0.520	0.321	0.540	0.438
Cu. Ft. of Gas per Sq. Ft. of Radiation for February, 1931	101.76	40.99	72.82	45.02	75.65	61.44

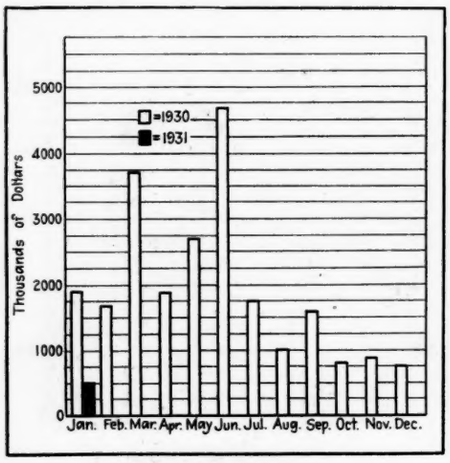
(See Footnote, page 120)


MODERN
SUBSTANTIAL
ADMIRABLE
OHIO SAVINGS BANK AND TRUST COMPANY
TOLEDO
Architect: Mills, Rhines, Bellman and Nordhoff, Toledo; General Contractor: A. Bentley & Sons, Toledo; Plumbing and Heating Contractor: Howard C. Baker Company, Toledo
UNUSUAL interest attaches to the new 30-story building of the Ohio Savings Bank and Trust Company in Toledo, for unusual measures were taken to assure wise investment of the five and a half million dollars involved.
Bank and office buildings in every part of the United States were visited and compared and the experience of their owners drawn upon. Every specification of material or equipment passed under searching scrutiny. The aim was to embody all that is most modern and known to be worthy, for such a building. The result has been much commended.
The choice of NATIONAL Copper-Steel Pipe for the major tonnage of pipe in this fine structure is but more testimony to the reputation among informed users of NATIONAL
NATIONAL

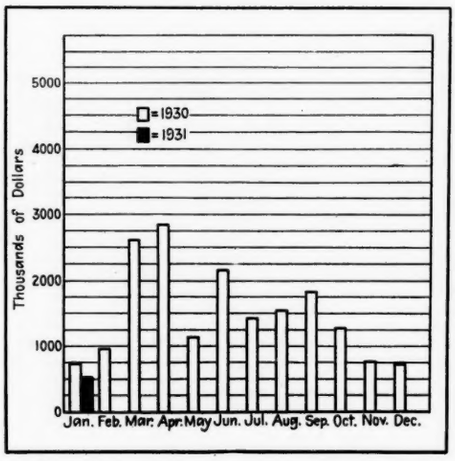
Statistical Service

EIGHT of the nine charts shown below indicate the amount of money spent for *heating and ventilating equipment in various classes of new buildings.* These figures are based on data supplied by the F. W. Dodge Corporation and multiplied by a factor depending on the type of building. This factor has been determined after consideration of the factors used by the Heating Board of Trade of New York and by C. Stanley Taylor in his Forecast appearing annually in this publication and those determined by survey by the H. & P.C.N.A.

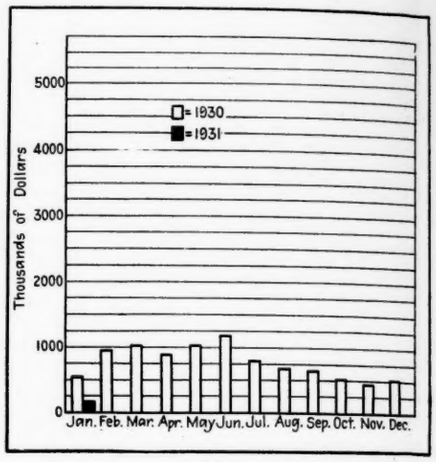
The remaining chart covers mechanical stokers for heating boilers and furnaces as reported by the Department of Commerce, this being the first month the report has been available.



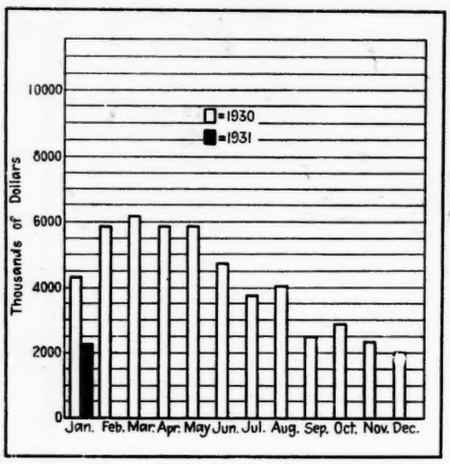
Industrial Buildings
January, 1931, $503,000; January, 1930, $1,913,000; decrease, 73.6%.



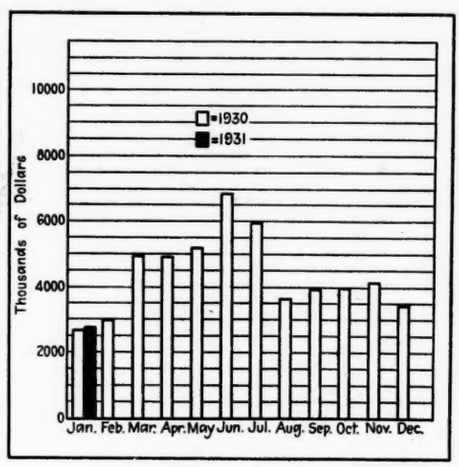
Hospital and Institutional Buildings
January, 1931, $534,000; January, 1930, $746,000; decrease, 28.4%.



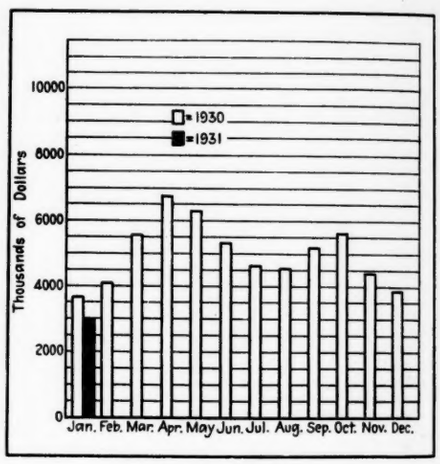
Religious and Memorial Buildings
January, 1931, $169,000; January, 1930, $550,000; decrease, 69.3%.



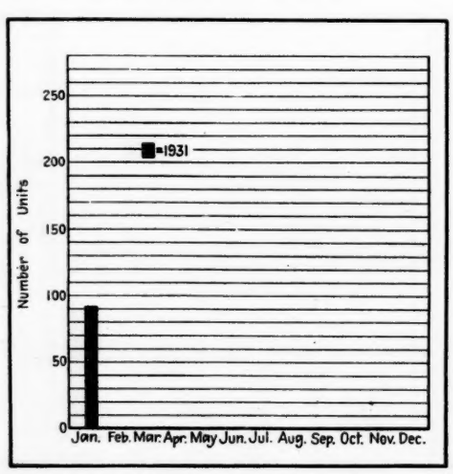
Commercial Buildings
January, 1931, $2,274,000; January, 1930, $4,324,000; decrease, 47.5%.



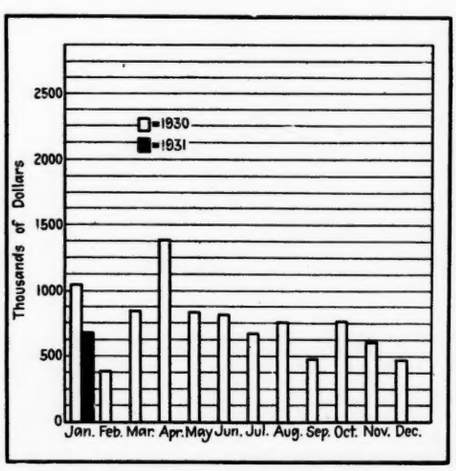
Educational Buildings
January, 1931, $2,717,000; January, 1930, $2,661,000; increase, 2.1%.



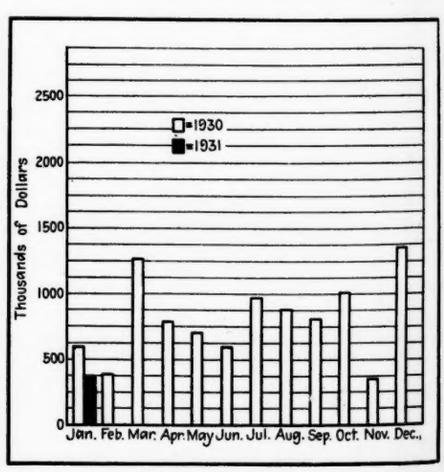
Residential Buildings
January, 1931, $2,991,000; January, 1930, $3,665,000; decrease, 18.4%.



Mechanical Stokers for House-Heating
(In Number of Units) January, 1931, 91; not available for January, 1930.

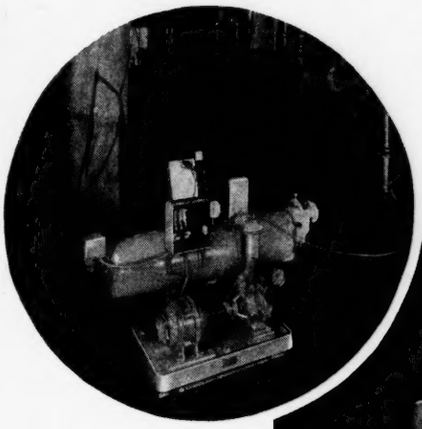


Social and Recreational Buildings
January, 1931, $685,000; January, 1930, $1,048,000; decrease, 34.6%.

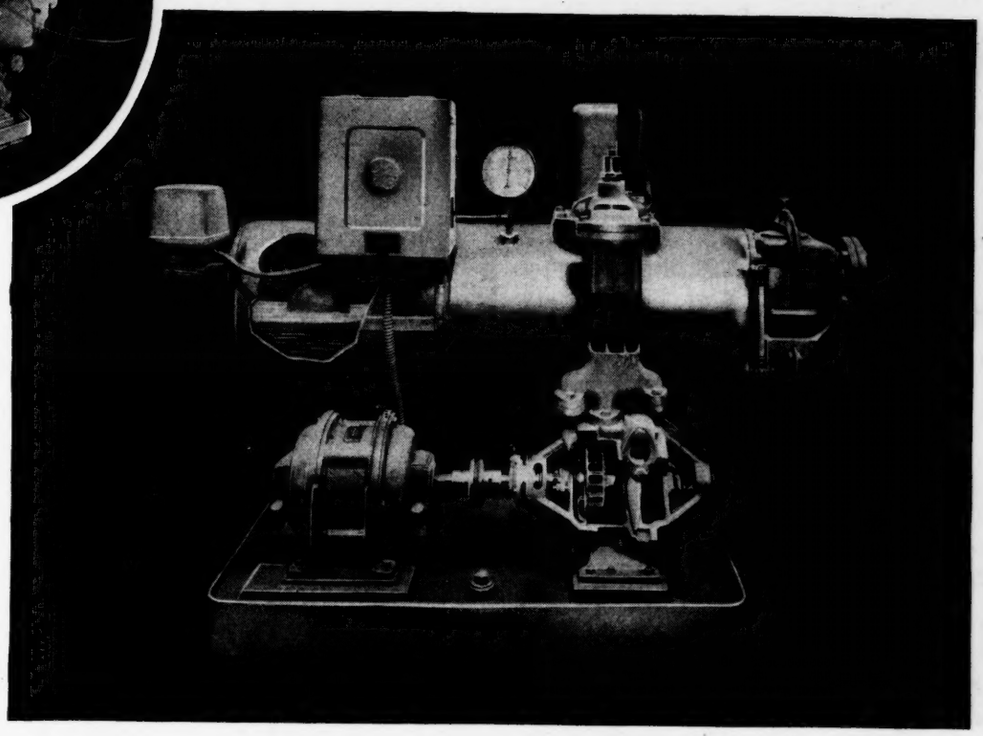


Public Buildings
January, 1931, $375,000; January, 1930, $600,000; decrease, 37.5%.

SOUND DESIGN...
TESTED CAPACITIES



Jennings Pump on test in Nash laboratory.



Cut-away view of a Jennings Vacuum Heating Pump. These units are furnished in capacities of 4 to 400 g. p. m. of water and 3 to 171 cu. ft. per min. of air. For serving up to 300,000 sq. ft. equivalent direct radiation. Write for Bulletin 85.

. . . your assurance of good performance

TWO independent units comprise the Jennings Vacuum Heating Pump. One pumps only water, the other only air. Each is designed for maximum efficiency and the capacity of each remains constant regardless of the volume being delivered by the other. Total pump capacity is always maximum air capacity plus maximum water capacity. This feature of design, found only in the Jennings Heating Pump, assures ample working capacity under all conditions.

Working capacity is checked at the factory. Each Jennings Pump is carefully tested to make sure that it delivers simultaneously its full rated g. p. m. of water and cu. ft. per min. of air. A Jennings Vacuum Heating Pump can be depended upon to keep any system, of the size for which it is recommended, free of air and condensation.

Jennings Pumps

THE NASH ENGINEERING CO 81 WILSON ROAD, SOUTH NORWALK CONN.